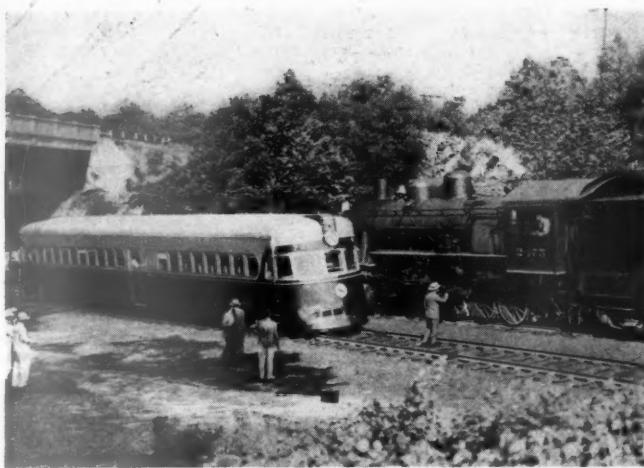


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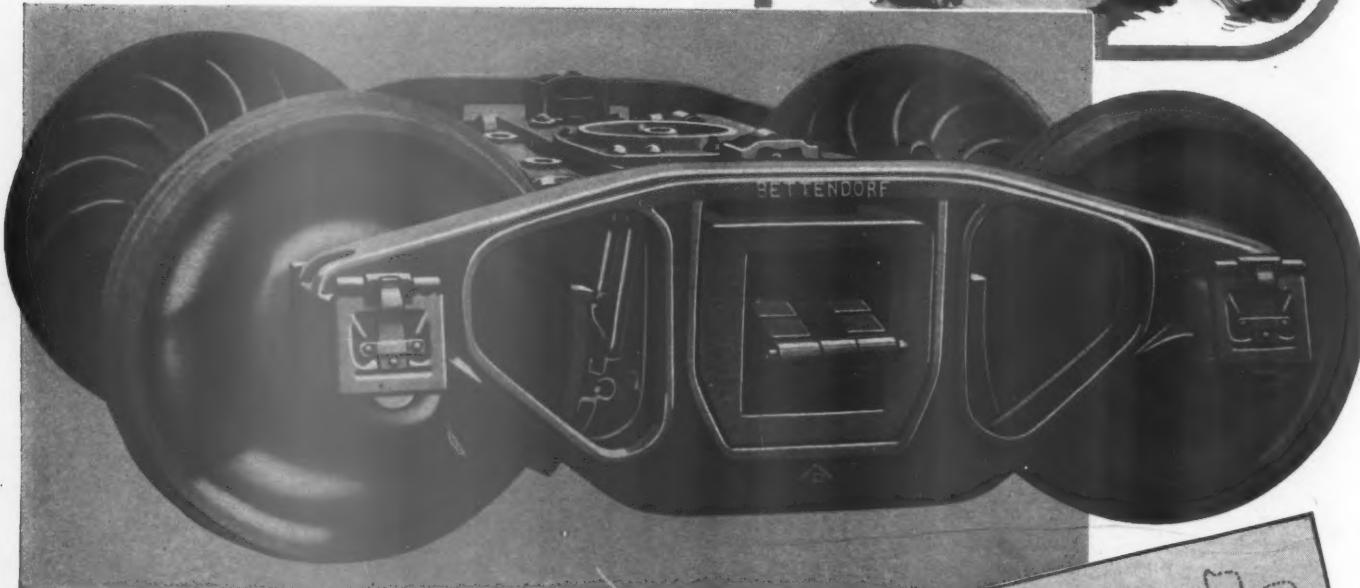
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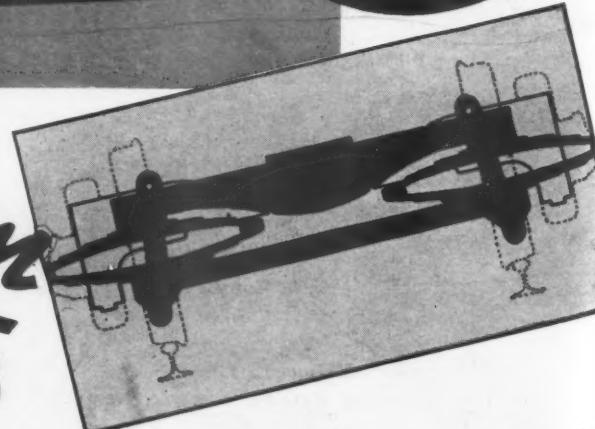
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Air-Cooled Rail Cars

ON JULY 15 the New York, Susquehanna & Western placed two 80-passenger rail cars in commuter service between Susquehanna Transfer, N. J., Paterson and Butler. These cars operate in a service requiring a total of 50 trips a day and each car accumulates about 430 miles a day. The trips vary in length from 15.3 to 34.4 miles.

These two cars were built by the American Car and Foundry Company and embody that builder's standard construction, employing spot welding and riveting, as the basis for design. USS Cor-Ten steel is used extensively in the structural members and aluminum alloys for the interior finish and roof. The side sheets are Armco high-tensile steel. The principal weights and dimensions are shown in an accompanying table. The cars being designed especially for suburban service have wide center entrance doors and vestibules to facilitate speedy loading and unloading. The doors are of the sliding type, operated by air and controlled by the conductor. An innovation in arrangement appears in the ability to convert the unused operator's compartment at either end into a saloon when the cars are used for excursion trips. This is accomplished by means of an ingenious arrangement of door and window curtains.

Light-weight, alloy-steel, air-conditioned cars for suburban service are powered by supercharged oil engine and have hydraulic-mechanical drive

Car Structure

The underframe is built up of rolled Z-section side sill members to which the transverse equipment supports and floor supports are welded. Rolled channel shaped center sills are welded in fore and aft of the bolster in order to carry the buffing loads back to the bolster and thence to the side girders. A combination of rolled Z shapes extending from side sill to side sill and isolated from the car floor are welded in to facilitate three-point suspension of the engine mounted beneath the floor.

The bolsters are the box section type of welded construction consisting of top and bottom cover plates and web plates. Flange stiffeners and gussets are welded in



The interior is in two sections, with equipment compartments and doors at the center

at the vulnerable points in order that the stresses will be smoothly transferred.

Light gauge steel false floor sheets are welded to the above-mentioned underframe members, thus forming a water tight and fireproof bottom covering for the floor.

The side frame is of girder type construction with rolled angles forming side sill or bottom chord and a light weight rolled Z-bar and rolled angles for side plate or top chord member. The posts are pressed flanged U-sections which when spot welded to the 14-gage side



The interior framing with the insulation in place

sheets form a stiff, light-weight box section. The belt rails and window headers consist of pressed Z-shaped members, and are arc welded to the side posts in such a manner that they function as continuous members.

These framing members are first assembled on jigs and then are arc welded, forming a skeleton to which the side sheets are spot welded.

The roof framing consists of light weight side plate angles to which are arc welded pressed Z-shaped carlines. Four Z-shaped purlines are welded to the carlines and run the entire length of the car and when riveted together with the carlines and the $\frac{1}{16}$ -in. aluminum roof sheets form a stiff sub-assembly which is riveted to the side frames. Further rigidity is gained by the light trussed framing which is fastened beneath the carlines to support the headlining and the air-conditioning duct.

The end frame is built up of welded construction with substantial pressed end posts to meet A. A. R. requirements and extending from the center sills at the bottom to the anti-telescoping sheet at the top.

The ends accommodate five windows which give the operator excellent vision around the entire front of the car. Both ends of the car have been made the same, as the car operates in either direction.

The Oil Engine

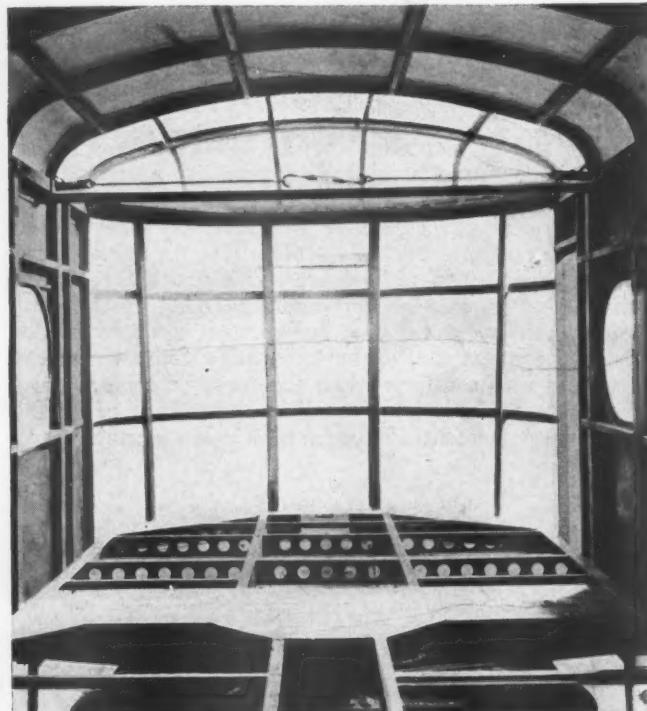
The power plant for these cars is an oil engine built by the Waukesha Motor Company, Waukesha, Wis., for the American Car and Foundry Company under license of the Hesselman Motor Company, Stockholm, Sweden.

While this engine is similar in many ways to the compression-ignition Diesel engine with its intake charge of air alone and its solid injection of the fuel oil, it differs from the conventional Diesel engine in employing a

positively-timed electric ignition system supplied by high-tension magneto. The substitution of spark ignition for high-compression pressures and correspondingly high explosion pressures makes it possible to secure greater horsepower and greater flexibility from a given basic engine weight than is possible with conventional high-pressure Diesel engines.

The compression pressure at full throttle is approximately 135 lb. per sq. in. while the maximum explosion pressure at full throttle will hardly exceed 450-500 lb. per sq. in. This engine is a six-cylinder, horizontal, overhead valve unit with cylinders $6\frac{1}{4}$ -in. bore by $6\frac{1}{2}$ -in. stroke, and 1,197 cu. in. displacement. In the present form, employing a supercharger, the output of the engine is nearly 30 per cent greater than the conventional non-supercharged unit of the same size and is capable of propelling the car, fully loaded, at speeds up to 60 m. p. h. at 1,800 r. p. m. engine speed.

The upper side of the engine, beneath the floor, has the Bosch fuel injection pump and the Hesselman open-type nozzles which are easily accessible through trap



The framing between the bolster and the car end

doors from the interior of the car. On the same side is located the supercharging ducts and the throttle box controlled by a centrifugal governor built into the engine. The engine drives through a Twin Disc torque converter which carries the operation up to approximately 40 m. p. h. when the engineman's control is thrown into full running position and a direct drive clutch is engaged.

OVERRUNNING CLUTCHES PERMIT FREE COASTING WHEN THE POWER IS SHUT OFF. INCLUDING THE SUPER-CHARGER, THE 20-KW. GENERATOR FOR LIGHTING, AIR CONDITIONING AND OTHER AUXILIARIES, THE PARASITE LOAD ON THE ENGINE IS APPROXIMATELY 40-50 HP. AT ALL TIMES. THE GOVERNOR MAINTAINS THE NECESSARY SPEED AND OUTPUT TO HANDLE THIS AUTOMATICALLY.

A separate head casting carries the intake and exhaust valves, the valve rocker arms and supports as well as the injection nozzle and spark plug. It is demountable for servicing and grinding of valves, and is



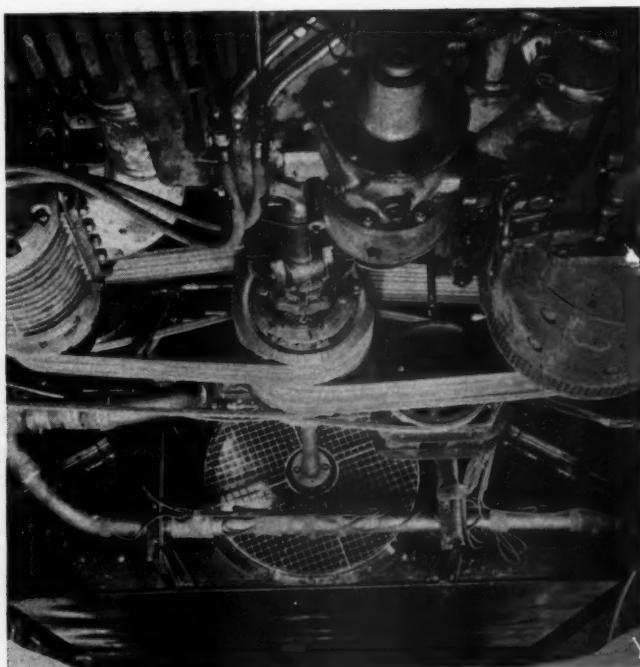
The Waukesha-Hesselman horizontal supercharged oil engine



The engine and transmission is installed entirely beneath the car floor and is accessible for adjustments

arranged in two castings, each carrying the valve gear and mechanism for three cylinders.

The main crankcase consists of an alloy-iron outer case into which are inserted molybdenum-iron wet sleeve cylinders. At the valve end the sleeve is sealed against water leaks by the head and cylinder block gasket. At the opposite end, two composition rubber rings seal it against leaks into the crankcase. The crankshaft has seven 4 in. main bearings which ride in renewable steel-backed, babbitt-lined bushings. The connecting rods are equipped with similar precision bearings $3\frac{3}{8}$ in. in diameter. Rifle drilling through the connecting rod brings oil under pressure to the piston pin which floats freely in a bronze bushed bearing at the small end of the rod, and in broached holes directly in the aluminum bosses of the piston. A special hole drilled in the large end of the connecting rod provides an intermittent jet of oil which is thrown into the camshaft tunnel shown directly above it.



The principal auxiliaries, such as generators and air compressor are driven by V-belt from a main shaft sheave

The oiling system is unusual in that the oil pump is built with two sections, one a scavenger section and the other a pressure section, and in addition to the main oil pump a second scavenger pump is located at the front end and driven directly by helical gears from the main crankshaft timing pinion. Throw-off from the crankshaft and other parts of the interior of the engine drains back into the outer sump which is separated from the main sump by a dam wall 12 in. to 14 in. high. The scavenger section of the main oil pump lifts the oil out of the scavenger sump and drops it into the main oil sump whence it is picked up by the pressure section of the pump and distributed through drilled passages in the case and suitable connections to all of the working parts of the engine.

An interesting feature of this engine is the fuel system. Unlike the high-pressure Diesel engine, the Hesselman engine controls both the fuel and the air employed so that a fuel-air ratio is maintained throughout

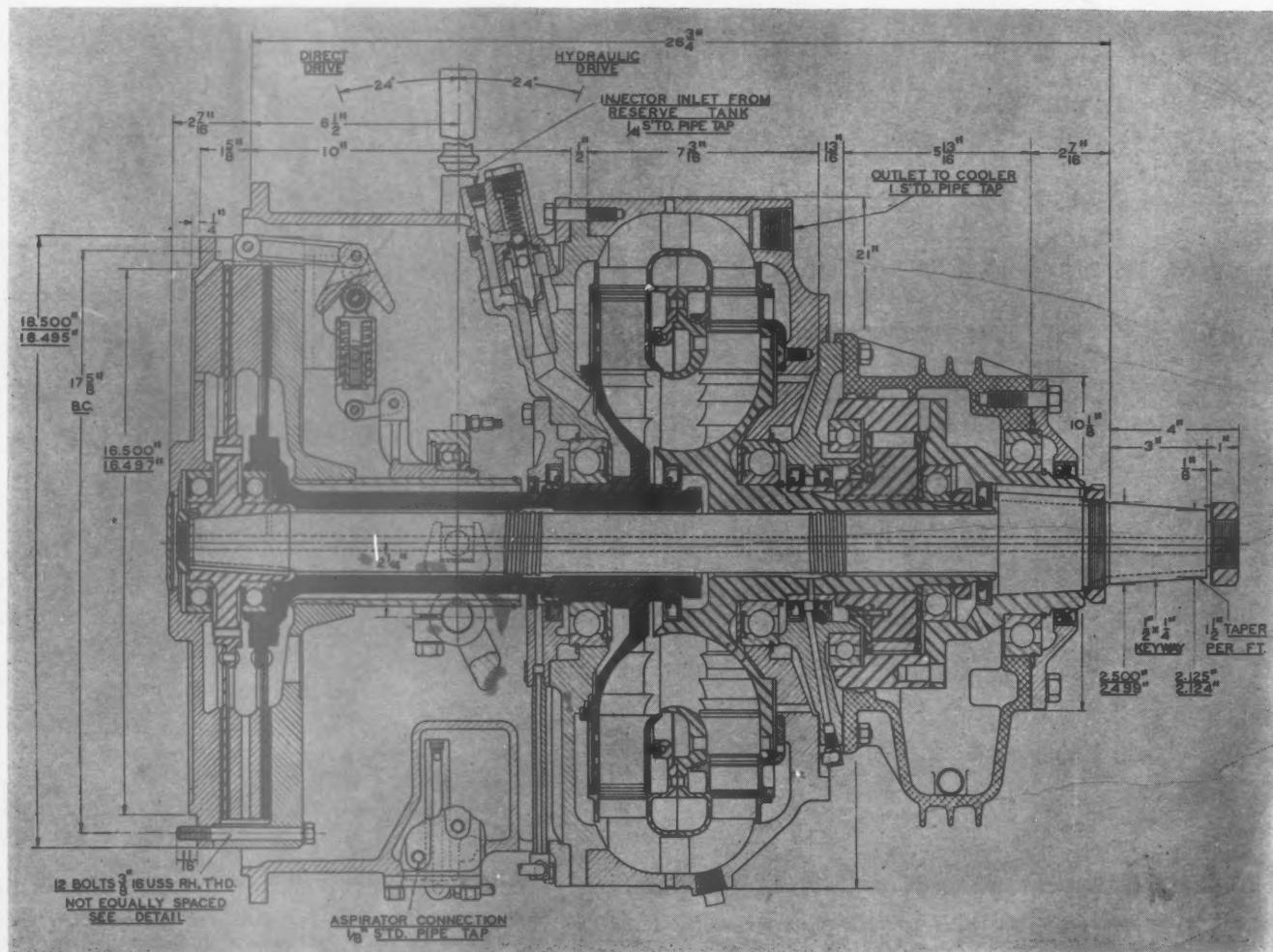
the entire speed and power range. Excessively lean mixtures at light load or excessively rich mixtures at heavy load are thus avoided and the smooth acceleration, absence of detonation and ignition delay due to variations in the fuel characteristics are avoided.

Speed control and the output of this engine is effected entirely by a simple butterfly valve in the air intake to the super-charger. As this throttle is closed, it creates a vacuum in the suction line of the supercharger which is communicated to a piston in a vacuum cylinder attached to the rear of the fuel pump. A vacuum, as it acts on this piston, moves the piston to the left and shuts off the fuel. When the butterfly is opened, the

from the fuel oil system. The fuel useable in this supercharged engine is of the most economical type as it does not require a high cetane ignitability rating. The maximum cetane recommended by the builders is 30 which permits the use of many low cost distillates and other fuels unsuited to compression ignition engines.

The Transmission

The transmission consists of a Twin Disc direct-drive converter containing a hydraulic torque converter, direct and free-wheeling feature; a drive shaft with midship bearing and universal joints to transmit the power to the drive axle on one axle of the truck. The mecha-



Sectional view of the Twin Clutch direct-drive converter with hydraulic torque converter

vacuum is reduced and the springs back of the piston move the fuel volume control to the right, feeding more fuel. A controlled and responsive adjustment results between the volume of air and the volume of fuel.

Hesselman nozzles employed with this Bosch injection system are of the open type with three simple ball check valves. There are no moving parts in the fire zone or the tip and only two orifices of relatively large diameter, .024 in. This construction with large passages and orifices reduces nozzle servicing problems and is possible because the low pressures employed in compression do not involve such high injection pressures.

The starting system is a standard 12-volt Delco starter, which is adequate for this engine, and is also made possible by the low engine pressures. Starting is effected by the injection of gasoline into the intake manifold for a short warm-up period followed by injection

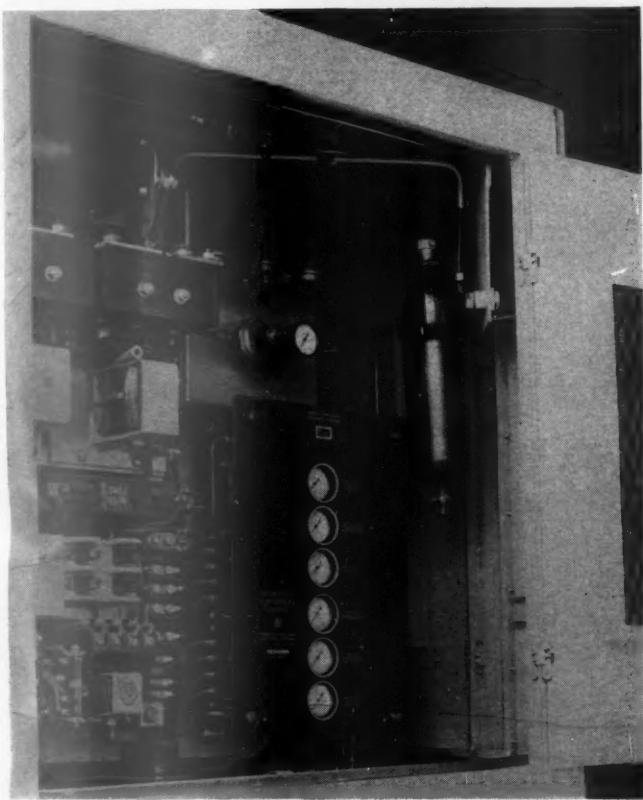
nism on the drive axle is for forward and reverse operation and is made up of two floating spiral-bevel ring gears meshing with a common pinion. A jaw clutch sliding on splines on the axle shaft engages one ring gear or the other depending on which direction the car is to operate. The jaw-clutch-shifting mechanism is actuated by air cylinders controlled by an electric switch in the operator's cab.

In the Twin Disc direct-drive converter the drive from the engine is taken through one or the other of two driving plates in a duplex clutch which has a spring-loaded over-center action. One of the clutch plates is mounted on a hollow shaft and is connected to the pump impeller of the hydraulic drive. The clutch plate nearest the engine engages the direct drive shaft passing through the hollow shaft and the center of the converter.

The shift from hydraulic into direct drive is made at

a speed of from 35 to 40 m. p. h., equivalent to an engine speed of about 1,200 r. p. m. Direct drive operation is from 1,200 to 1,800 r. p. m.

A freewheel is provided between the turbine and the output shaft in order to disconnect the turbine entirely when the unit is in direct drive. This disconnection eliminates losses due to the drag of the hydraulic parts.



Air conditioning control panel



Evaporator and blower motor in aisle compartment

The freewheel unit is the mechanical type consisting of rollers spaced by means of a cage between the inner cam and the outer race. When in hydraulic drive, the rollers are engaged and constitute the drive between the cam and the outer race mounted on the turbine hub and the output shaft, respectively. When in direct drive, the outer race overruns the cam, and the rollers are dropped back into the recesses in the cam. Lubrication is provided by constant circulation of oil through the unit. A separate oil-cooling unit is provided for the hydraulic unit.

The clutch is actuated electro-pneumatically. An electrically controlled air cylinder shifts either clutch into engagement and provides a neutral position when both are disengaged. The clutch-operating cylinder is, in turn, controlled by electric switches in the operator's cab.

All accessories are driven by V belts from a main sheave which is in turn driven by a propeller shaft off the rear or timing gear end of the engine crankshaft. The accessories comprise the supercharger, 125-volt d. c. generator, 12-volt generator, engine cooling water pump and two Bendix-Westinghouse 12-c. f. m. air compressors.

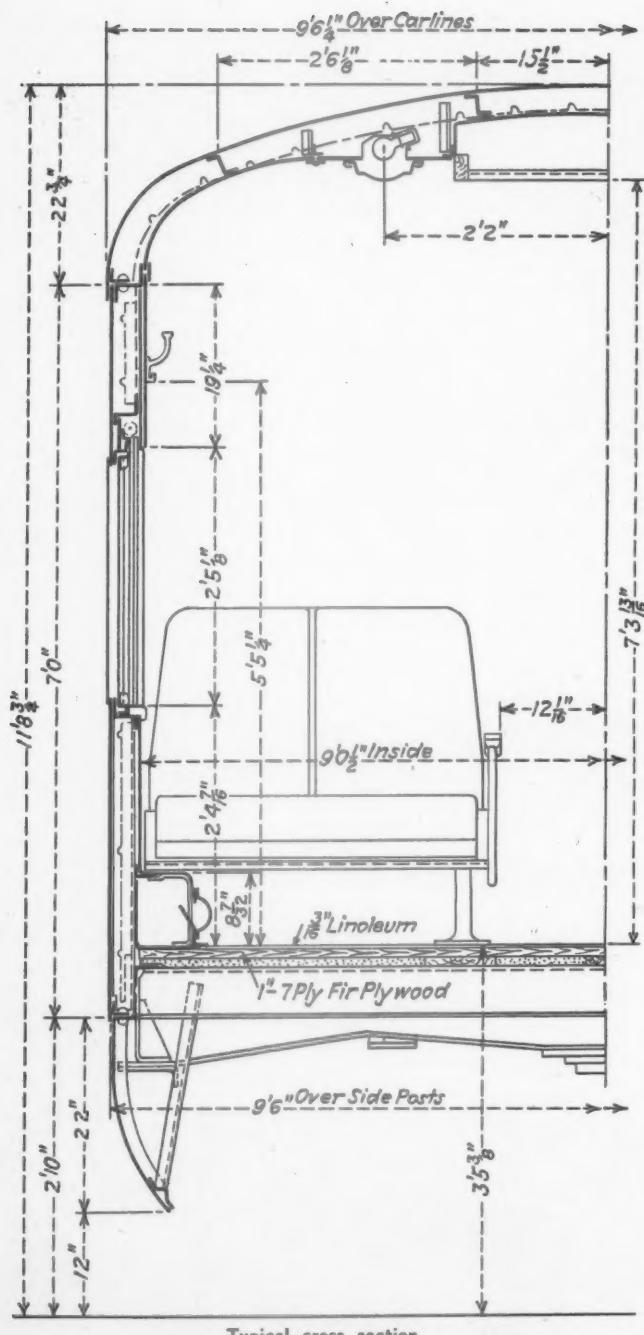
There are two sections of engine cooling water radiators arranged across the car immediately behind the accessories and their belt drives. The radiator cores are of the fin and tube type. Engine water temperature is regulated by automatic thermostatically controlled radiator shutters. The radiators are cooled by two 27 in. dia. aluminum fans mounted on a common shaft. The fans are driven by a propeller shaft, having a flexible rubber joint at each end, one end of which is attached to the main belt sheave. The engine cooling water also cools the torque converter fluid by means of a heat exchanger.

Air Conditioning and Heating

These cars are equipped with the American Car and



Water and electric heater in the opposite aisle compartment



Typical cross section

Foundry Company's all-weather system. The air conditioning system of $6\frac{1}{2}$ tons capacity, is the electro-mechanical type using Freon. The motor-driven compressor and the condenser are beneath the car floor, accessible from the side, and the evaporator and fan equipment is located in one of two compartments at the center of the car adjacent to the doors. In the other com-



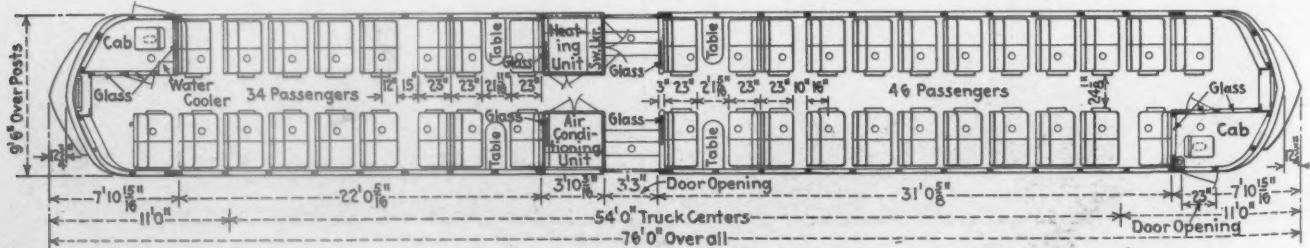
The operator's cab may be converted into a saloon

Principal Weights and Dimensions of the New York, Susquehanna & Western Lightweight Rail Cars

Light weight of body shell, lb.	19,550
Light weight of finished car body, lb.	54,120
Truck, drive, lb.	10,360
Truck, trailing, lb.	9,020
Total light weight on rails, lb.	73,500
Estimated water, fuel, oil, crew, etc., lb.	3,000
Total service weight on rails, lb.	76,500
Total load passengers and mail, lb.	12,200
Total loaded weight on rails, lb.	88,700
Length over pilots, ft.-in.	76-0
Width over side frames, ft.-in.	9-6
Height, rail to top of roof, ft.-in.	11-8 3/4
Height, rail to top of floor, ft.-in.	3-5 3/8
Height, floor to ceiling air duct, ft.-in.	7-4
Seating capacity	80

partment the heating equipment is installed. Fresh air is taken in through a duct below the compartment and the cold air passes out at the top into distribution ducts at the center of the car ceiling. The system is governed by automatic temperature and humidity control.

In the heating equipment compartment at the opposite side of the aisle there is a fin-type radiator through which the jacket water from the engine passes. A modulating valve in the hot water line to the heating coil proportions the volume of water to the heating de-



Floor plan of the Susquehanna rail cars

mand. The valve is actuated by a controller in the hot air discharge duct. The heated air is blown out into ducts near the floor at each side of the car. The heat derived from the above source is supplemented by a 12 kw. electrical heating unit in the same compartment. The heating system is under automatic control and compensates the temperature level as a function of the outside temperature and inside relative humidity.

Supplementing the air condition system, to be used in emergency, are two drop windows at each end of the car operating as air intakes. These windows are the crank down type. Single fixed sash are used for the remainder of the windows.

The cars are insulated throughout with Johns-Manville Stonefelt.

Electrical Equipment

The electrical equipment on these cars takes advantage of the dual voltage system using 12 and 125 volts. The 12-volt system is used for engine starting, engine safety devices, marker, classification and headlights. Each headlight is equipped with a 12-volt 30-ampere bulb, which has a pick-up distance considerably in excess of the conventional locomotive headlight. The 12-volt 25-plate battery is charged from 40 ampere generator belt driven from the engine.

The 125-volt system consists of a 20 kw. 125-volt, belt driven generator which is capable of delivery at rated capacity, while the power plant is operating over a speed range of nearly 4 to 1. Cool cleaned air for the generator is supplied through a louvred opening in the side of the car, which has a suitable dust connection to the generator. The generator supplies the necessary power for air conditioning, electric heat, lights, control and other electrical accessories, and at the same time charges a 56-cell KX-7-H Exide Ironclad battery.

The lighting is by means of Luminator fixtures at each seat location in the side ceiling. These fixtures are fitted with lenses which assure ample illumination at the reading plane.

Trucks, Couplers and Brake Equipment

The cast-steel framed trucks are of four-wheel design. The truck bolsters are cast steel supported on transverse full elliptic springs. The axles are mounted in Timken roller bearings. The power application is through one axle of one truck. The brake cylinders are mounted on supports secured to truck frame cross members and are located just inside the wheels. Special attention has been given to sound deadening in the trucks. The cars are equipped with New York Air Brake Company's Schedule SME brake designed to stop from full speed in 24 sec. or 0.2 mile at a braking rate of 2.5 m. p. h. per second.

Coupler pockets are concealed under the sheathing at each end of the car; flush, removable covers are used in the sheathing.

Partial List of Material and Equipment on the New York, Susquehanna and Western Rail Cars

Aluminum	Aluminum Co. of America, Pittsburgh, Pa.
Steel	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Side sheets	American Rolling Mill Co., Middletown, O.
Step treads	Republic Steel Corp., Massillon, O.
Plywood	Harbor Plywood Corporation, Hoquiam, Wash.
Engine	Waukesha Motor Co., Waukesha, Wis.
Muffler	Burgess Battery Co., Madison, Wis.
Tachometer	Weston Electrical Instrument Corp., Newark, N. J.
Pulleys	Dayton Rubber Mfg. Co., Dayton, O.
Throttle control system	Bendix Products Div., Bendix Aviation Corp., South Bend, Ind.
Pulley and fan; voltage regulator; magnetic switch; starting motor	Delco-Remy Corp., Div. General Motors Corp., Anderson, Ind.
Propeller shaft bearing	SKF Industries, Philadelphia, Pa.
Propeller shaft and bearing	Spicer Mfg. Corp., Toledo, O.
Heat exchanger; radiators	Young Radiator Co., Racine, Wis.
Torque converter; sight level gasket	Twin Disc Clutch Co., Racine, Wis.
Rubber mounting torque converter stabilizers	U. S. Rubber Co., New York.
Pressure gage	Manning, Maxwell & Moore, Inc., Locomotive Equipment Div., Bridgeport, Conn.
Rubber hose, belts	Gates Rubber Co., Denver, Colo.
Water gage	Lunkenheimer Company, Cincinnati, O.
Copper tubing and fittings	Chase Brass & Copper Co., Inc., Waterbury, Conn.
Air filter	Air-Maze Corporation, Cleveland, O.
Roller bearings	Timken Roller Bearing Company, Canton, O.
Truck frames; bolsters	American Steel Castings Co., Newark, N. J.
Wheels; axles	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Springs	American Locomotive Co., Railway Steel Spring Div., New York.
Couplers	McConway & Torley Co., Pittsburgh, Pa.
Brake shoes	American Brake Shoe & Foundry Co., New York.
Air compressor	Bendix Westinghouse Automotive Air Brake Co., Pittsburgh, Pa.
Air brakes	New York Air Brake Co., New York.
Hand brake	National Brake Co., Buffalo, N. Y.
Glass	Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Torque arm Neoprene pads; glazing cork strip	Armstrong Cork Co., Lancaster, Pa.
Insulation	Johns-Manville Sales Corp., New York.
Air conditioning	American Car and Foundry Co., New York.
Air conditioning controls	Minneapolis-Honeywell Regulator Co., Wash., Ind.
Exhaust ventilating fans	Diehl Mfg. Co., Elizabethport, N. J.
Cooling fans	B. F. Sturtevant Co., Hyde Park, Boston, Mass.
Batteries	Electric Storage Battery Co., Philadelphia, Pa.
Generators	General Electric Company, Schenectady, N. Y.
Body lights	Luminator, Inc., Chicago.
Headlight reflectors; headlights	Electric Service Supplies Co., Metal Products Div., Philadelphia, Pa.
Bell operating valves	U. S. Metallic Packing Co., Philadelphia.
Fire extinguisher	Walter Kidde & Company, Inc., Bloomfield, N. J.
Air sander trap	Graham-White Sand Corp., Roanoke, Va.
Tyfon horn	Leslie Co., Lyndhurst, N. J.
Bell and ringer	American Locomotive Co., New York.
Door track valve	National Pneumatic Co., Rahway, N. J.
Linoleum	Armstrong Cork Co., Lancaster, Pa.
Body seats	Coach & Car Equipment Corp., Chicago.
Ajax cup dispenser	Logan Drinking Cup Div., U. S. Envelope Co., Worcester, Mass.



Combating

Locomotive Obsolescence*

THE demand for faster service, longer runs and high mileage on the railroads has left almost all of them with many locomotives which are not adapted to meet such requirements. In other words, the horsepower demand cannot be met. Many of these locomotives may be improved for faster and more sustained service by making changes which will not incur a great deal of expense.

Degree of Obsolescence of Nation's Motive Power

In attempting to approximate the extent to which our road-service steam motive power may be considered modern, the author uses as an example the locomotives of the St. L.-S. F., which is considered an average-size railroad. Out of an ownership of 610 locomotives, 425 or 70 per cent are assigned to road service. In view of the speeding up of freight and passenger schedules, the horsepower rating of locomotives is a better yardstick to apply than the rated tractive force which is so frequently used. Thus, using Cole's values for cylinder-horsepower rating for locomotives built prior to 1920 and the railway company's test results for those built in 1920 and later, the 425 locomotives having road assignment have a rating of 1,096,100 hp., an average of 2,579 hp. each. Table I indicates the periods in which certain of these locomotives have been built.

Table I—Period of Building Locomotives of the St. Louis-San Francisco Railway

	Horsepower rating	Percentage of total
1935 and later	132700	12.0
1930 and later	220700	20.0
1923 and later	543200	49.5
1919 (U. S. R. A.) and later	623500	56.7

Of the locomotives producing 220,700 hp. built or rebuilt in 1930 and later, only 132,700 hp., or 12 per cent of the total considered, fully meet the transportation department's operating requirements and have the desired proportions for economy of operation and maintenance. There are 31 locomotives included in this 12 per cent, having an average rating of 4,300 hp. Numerically, these locomotives are 7.3 per cent of the total having road-service assignment.

Now considering the railroads as a whole, we find that in 1939 reports were filed for 45,965 steam locomotives. Should the road-service ratio of 70 per cent be applied to the 45,965 steam locomotives reported in order to arrive at the approximate number having road assignment, we would have a total of 32,175.

The record of purchases of steam locomotives for service in the United States 1934 to 1939, inclusive, is given in Table II. Numerically, the 699 steam locomotives listed in Table II, purchased for road service, constitute only 2.2 per cent of the 32,175 steam locomotives considered as having assignment to this service. These new locomotives have approximately double the rated horsepower capacity of the average of the total and accumulate mileage at rates two to three times that of the average. On this basis, they should account for

* Abstract of a paper presented at a session of the Railroad Division at the semi-annual meeting of the American Society of Mechanical Engineers at Milwaukee, Wis., June 17-20, 1940.

† Mechanical engineer, St. Louis-San Francisco.

By J. L. Ryan †

Improvements may be effected in capacity and economy by re-proportioning locomotive parts subject to renewal—The author sets forth a number of specific suggestions

10 to 15 per cent of the transportation movement. This leaves 85 to 90 per cent of the movement being handled by locomotives built prior to 1934. A number of the freight locomotives, built in the period 1928 to 1931, were proportioned to meet present operating requirements; the majority, however, while having good boiler proportions and good steam distribution, continued with wheel diameters which are a handicap today.

Returning to the figures on the locomotive ownership of the St. L.-S. F., it will be observed that, of the 1,096,100 rated horsepower, representing the total capacity of the 425 locomotives assigned to road service, locomotives having 12 per cent of the rated total are considered modern, while locomotives accounting for 44.7 per cent of the rated total were built commencing with the U. S. R. A. period and from then on to the time when those having modern operating proportions were constructed.

With the groups of locomotives in mind which will fall within the period of construction of the 44.7 per cent mentioned, it is suggested that studies similar to the following be undertaken with the object of making maintenance replacements as nearly according to modern proportions as possible in preference to the "as-built" pro-

Table II—Steam Locomotive Purchases: 1934-1939

Construction orders placed	Road	Service	Yard
1934	63	9	
1935	17	11	
1936	349	84	
1937	149	27	
1938	33	2	
1939	88	2	
Total	699	135	

portions. Regardless of our opinions with respect to the economical retirement age of equipment, these locomotives will, in all probability, be continued in service for many years.

In some instances at no additional cost, and in many instances at a nominal additional cost, distinct improvements may be effected in the capacity and economy of locomotives by the re-proportioning of parts which are subject to renewal from time to time through the routine of maintenance.

Boiler Proportions Which Should Be Examined

The boiler is an excellent starting point when reviewing the design and proportions of a locomotive for possible improvement.

Many of the boilers designed in the days of drag

service have inadequate steam space for the high steam-release rate obtained under present operating conditions. When a new firebox is applied, this condition can be readily corrected. The lowering of the crown sheet 3 in. will increase the volume of the steam space 20 to 25 per cent. This is frequently sufficient to transform a poor water-carrying boiler into a good performer. When this is effected, the results are: (a) better performance on line of road; (b) higher superheat temperature; (c) reduction in maintenance of valves, pistons and superheater units.

Locomotives designed for operation on heavy-grade lines and having permanent reassignment where only light-grade lines are encountered, should be checked for the lowest reading of the water glass relative to the highest point of the crown sheet and for the visible length of the water glass used. A gain of 15 to 20 per cent in steam space is at times possible by a slight lowering of the water glass and reduction in its visible length, maintaining the same degree of safety in operation on the light-grade line as prevailed on the heavy-grade line for which the locomotives were built.

The gas area through the barrel of the boiler is one of the all-important details which should be checked in order to provide the maximum attainable. In the design of locomotives constructed in the period 1919 to 1930,

temperatures of 700 to 750 deg. F. when we apply new tube sheets in the course of maintenance, the reportioning of the tube layout to provide high steam-chest temperatures offers an excellent opportunity for increased capacity and economy.

The tube-sheet layout of the U. S. R. A. locomotives is proportioned so that the 5½-in. flues will have a gas area of 45 to 46 per cent of the total gas area through the boiler. Such a proportion with the Type A superheater gives a steam temperature approximately 100 deg. F. below that desired in today's operation.

Table III shows the tube-and-flue application with resulting proportions for the U. S. R. A. 2-8-2 B type locomotive as built, as well as a number of possible applications without requiring any change in the crown height or water space around the combustion chamber. The order of application to attain increased capacity, as well as for fuel economy, would be as follows: (1) Type E superheater; (2) a 6-in. by 9-in. layout of 5½-in. flues with the application of Type HA superheater units or their equipment; (3) a 6-in. by 10-in. layout of 5½-in. flues with the top corner flues omitted; application of 58 Type A superheater units.

Increasing the capacity of the superheater effects a material gain in addition to that of reducing the steam rate per unit of work, since the increased number of

Table III—Possible Tube and Flue Applications on U. S. R. A. 2-8-2 B Type Locomotive Without Change in Dimensions of Back Tube Sheet

	A	HA or equivalent	A	E
Superheater type.....	5 × 9 (as built)	6 × 9	6 × 10
Superheater flue layout.....				
Distance over tube sheets, ft.	19	19	19	18
Number of 5½-in. flues.....	45	54	58	201-3½
Number of 2½-in. tubes.....	247	217	196	62-2½
Vertical pitch of 5½-in. flues, in.	6½	6½	6½	4.22 (mean pitch)
Pitch of 2½-in. tubes, in.	3	2½	2½	3
Heating surface of flues, sq. ft.	1226	1471	1580	3298
Heating surface of tubes, sq. ft.	2752	2418	2184	697
Total heating surface, tubes and flues, sq. ft.	3978	3889	3764	3995
Superheater heating surface, sq. ft.	993	1742	1280	1920
Steam area through superheater, sq. in.	51.3	61.6	66.1	71.92
Net gas area through boiler, sq. in.	1414	1447	1438	1427
Net gas area through 5½-in. flues, per cent.....	45.1	52.9	57.2
Approximate temperature range of steam in branch pipe, deg. F. at high work rate.....	630-640	HA 710-730	700-720	710-730
Maximum evaporation, tubes and flues (Cole's values).....	37984	37125	36175	39320
Maximum evaporation, including firebox heating surface (Cole's values).....	54809	54010	53060	56205

some railroads incorporated practices in the spacing of tubes which, today, are recognized as not being consistent with spacing that may be followed with good results, water treatment and welded flues effecting this permissible change.

A case in point was the building some years ago of 50 2-8-2 locomotives by a certain railroad, following in detail the boiler dimensions of the U. S. R. A. 2-8-2 B type, except for the layout of the tube sheets. The latter type had 45 flues 5½ in. in diameter and 247 tubes 2½ in. in diameter. The 50 locomotives of the 2-8-2 type mentioned have 45 flues 5½ in. in diameter and 219 tubes 2½ in. in diameter.

A kindred condition can also be found in the proportioning of some boilers having combustion chambers with the water space around the chambers greater than is now required for good practice. The area of the back tube sheet is generally the limiting factor in the tube application to these locomotives. A reduction of the water space around the combustion chamber when applying a new firebox could be capitalized upon through the application of additional boiler tubes.

Boiler-Tube-Sheet Layout and Superheat

With the results at hand on the improved cylinder performance of modern and semi-modern locomotives, a high percentage of which is attributable to steam-chest

units reduces the pressure drop, which at a high work rate is equivalent to a substantial increase in the boiler pressure.

Table IV contains examples of reportioning the superheater application on two classes of locomotives by the St. L.-S. F.

Effect of Valve Events on Locomotive Operation

As important as the proportioning of the boiler and the superheater are the valve events upon the operation of a locomotive. Classes should be checked having in mind today's assignment. A 4-6-2 type built to handle the heavy trains of another period with valves having 1 to 1½-in. steam lap, should not be assigned to light, high-speed trains without altering the valves and valve gear to provide events to suit. Locomotives of the 2-8-2 type designed in the days of drag service may be found operating on near passenger schedules and with practically the original restricted steam ports and valve events. This necessarily results in loss of power and fuel.

Classes which are receiving the application of new cylinders should have the diameter of the valve, area of the exhaust channels, and the steam ports carefully examined. They should be proportioned to meet today's requirements. Only a few locomotives need be involved to justify the cost of a new cylinder pattern, should it be required, in order to obtain the desired proportions.

Table IV—Examples of Reproportioned Tube-Sheet Layout by St. Louis-San Francisco Railway

	As built		Example No. 1 Reproportioned		Example No. 2 Reproportioned	
	A 5×9	A With No	A 7×9	HA With No	A 5×8	A None
Superheater type.....						
Superheater flue layout.....						
Combustion chamber—with or none.....						
Back tube sheet altered.....						
Distance over tube sheets, ft.-in.....	22-0		22-0	20-0	21-0	20-11
Number of $5\frac{1}{4}$ -in. flues.....	45		63	54	38	48
Number of $2\frac{3}{4}$ -in. tubes.....	251		211	242	225	176
Vertical pitch of $5\frac{1}{4}$ -in. flues, in.....	6 $\frac{1}{4}$		6 $\frac{1}{4}$	6 $\frac{1}{4}$	6 $\frac{1}{4}$	6 $\frac{1}{2}$
Pitch of $2\frac{3}{4}$ -in. tubes, in.....	3 $\frac{1}{4}$		3 $\frac{1}{4}$	3 $\frac{1}{4}$	3 $\frac{1}{4}$	3 $\frac{1}{4}$
Heating surface of flues, sq. ft.....	1420		1988	1548	1144	1440
Heating surface of tubes, sq. ft.....	3240		2724	2839	2772	2160
Total heating surface, tubes and flues, sq. ft.....	4660		4712	4387	3916	3600
Superheater heating surface, sq. ft.....	1233		1726	1834	978	1235
Steam area through superheater, sq. in.....	51.3		71.8	61.6	43.3	54.7
Net gas area through boiler, sq. in.....	1426		1556	1500	1245	1233
Net gas area through $5\frac{1}{4}$ -in. flues, per cent.....	44.7		57.4	49.3	43.3	55.2
Temperature range of steam in branch pipe, deg. F., at high work rate.....	590-620		690-710	690-720	680-700	
Maximum evaporation, tubes and flues (Cole's values).....	41,610		42,220	41,370	36,010	33,170

[†]Combustion chamber lengthened and syphon applied. Firebox heating surface increased 18.3 per cent.

Considering the fact that locomotives in freight service are rated today on their power output at piston speeds of 1,200 to 1,400 ft. per min., instead of on their initial tractive force, the responsibility devolves upon the mechanical engineers at least to point out the potential power increases which may be effected through moderate changes. At the time of heavy shopping, a valve gear, providing drag-service events, can be replaced with a gear providing modern events, often at slight cost over that which would be involved in maintaining the original in kind.

Table V, examples Nos. 1 and 2, are instances of altering the valve gears to meet changed assignments and operating conditions. In both cases the originals were for passenger service with running speeds of 55 to 60 m. p. h. The alterations were made to provide valve events to accommodate an economical cruising speed of 70 to 75 m. p. h., with occasional top speeds of 80 to 85 m. p. h.

What proportions and valve events should be provided to meet today's operating requirements most satisfactorily? The locomotives which we are considering are those built from 1919 to 1930, the majority having working pressures within the range of 200 to 250 lb. per sq. in.

The problem is to provide the highest possible mean effective pressure at piston speeds of 1,200 ft. per min. and higher. L. H. Fry's recent review* of the reproportioning of locomotives by the Paris-Orléans Railway may be read to advantage by those having to do with steam-locomotive proportions; also by those having to do with maintenance. In the latter case, the review should be studied in order that a better understanding will exist when a slight increase in maintenance is assumed in order to effect a substantial increase in the work-rate capacity.

Indicator cards, Figs. 1 to 4, inclusive, are shown as an example of the increase in mean effective pressure which may be effected through the adoption of a long

steam lap. They were taken from a 2-8-2 type locomotive having 45 Type A superheater units, 27-in. by 32-in. cylinder, 14-in.-diameter valves, $8\frac{3}{4}$ in. maximum travel. The valve setting for cards, Figs. 1 and 3, was as follows: $1\frac{1}{4}$ in. steam lap, $\frac{3}{16}$ in. lead, 0 in. exhaust clearance, $15\frac{1}{8}$ in. width steam port. The valve setting for cards Figs. 2 and 4 was as follows: $2\frac{1}{2}$ in. steam lap, $\frac{3}{16}$ in. lead, $\frac{1}{16}$ in. exhaust lap, $2\frac{3}{16}$ in. width steam ports.

Example No. 3, Table V, shows the steam lap, lead, exhaust clearance, valve diameter, maximum cut-off, etc., which the St. L.-S. F. uses as the most practical for fast heavy freight service. With a $1\frac{15}{16}$ in. steam lap and valve travel to provide 75 to 77 per cent maximum cut-off, auxiliary starting ports are not required. Cards shown in Figs. 5 and 6 were taken from the 2-8-2 type locomotives listed in Table V having 14 in. diameter valves with $1\frac{15}{16}$ in. steam lap. These cards were taken when the locomotive was operating with a piston speed of approximately 1,000 ft. per min.

It is not difficult to visualize the shrinkage in the mean effective pressure which would result from either a reduction in the diameter of the valve or in the steam lap.

With today's piston speeds of 1,200 to 1,600 ft. per min., it is doubly important that the inflow and outflow of steam be as unrestricted as is practicable. The use of valves of a diameter which may be considered large need not incur excessive weight. Lightweight built-up valves using gas pipe with a wall thickness of $\frac{3}{16}$ in. and steel castings having $\frac{1}{4}$ -in. section have been standard practice with the St. L.-S. F. for seven years.

Boiler Pressure

In the light of the excellent on-line-of-road operation which has been obtained from locomotives of recent

* "The Locomotive in France," by L. H. Fry, *Railway Mechanical Engineer*, December, 1938, page 473; January, 1939, page 1, and September, 1939, page 345.

Table V—Comparison of Change in Valve Events Made by the St. Louis-San Francisco to Meet Altered Operating Requirements With Examples of Recent Construction

Locomotive type.....	Example No. 1		Example No. 2		Example No. 3	
	Original 4-6-2	As altered 4-6-2 Light fast passenger	Original 4-6-2	As altered 4-6-4 Heavy fast passenger	Original 2-8-2	As altered 4-8-2 Freight
Class of service.....	Passenger		Heavy passenger	Conversion, heavy fast passenger	Freight	4-8-2 Freight
Boiler pressure lb. per sq. in.....	200	200	210	225	235	250
Cylinders, diameter and stroke, in.....	24 \times 28	24 \times 28	26 \times 28	26 \times 28	27 \times 32	27 \times 30
Drivers, diameter, in.....	69	73	74	74	64	70
Valves, diameter, in.....	13	13	13	13	14	14
Maximum travel, in.....	7 $\frac{1}{2}$	7 $\frac{1}{2}$	6 $\frac{1}{4}$	7 $\frac{1}{2}$	8 $\frac{1}{2}$	7 $\frac{1}{2}$
Steam lap, in.....	1 $\frac{1}{4}$	1 $\frac{1}{4}$	1	1 $\frac{1}{2}$	1 $\frac{1}{2}$	1 $\frac{1}{2}$
Lead, in.....	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
Exhaust clearance, in.....	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	0	0
Maximum cutoff, per cent.....	82	82	79	77	77	76

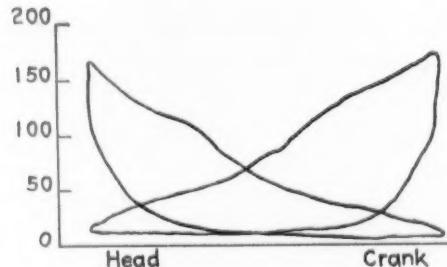


Fig. 1

Piston speed, ft. per min.	953
Cut-off, per cent	36.5
Boiler pressure, lb. per sq. in.	199
Mean effective pressure, head end, lb. per sq. in.	53.8
Mean effective pressure, crank end, lb. per sq. in.	66.7
Horsepower, right side	1,004
Total engine horsepower	2,008

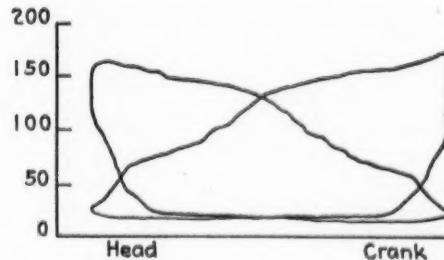


Fig. 4

Piston speed, ft. per min.	964
Cut-off, per cent	51
Boiler pressure, lb. per sq. in.	193
Mean effective pressure, head end, lb. per sq. in.	86.6
Mean effective pressure, crank end, lb. per sq. in.	93.8
Horsepower, right side	1,531
Total engine horsepower	3,062

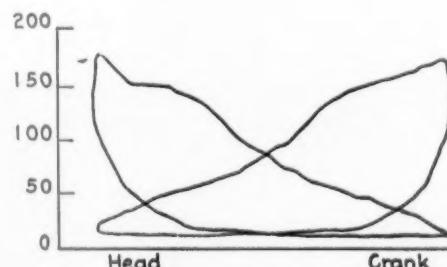


Fig. 2

Piston speed, ft. per min.	1,041
Cut-off, per cent	35.8
Boiler pressure, lb. per sq. in.	195
Mean effective pressure, head end, lb. per sq. in.	60.2
Mean effective pressure, crank end, lb. per sq. in.	76.1
Horsepower, right side	1,330
Total engine horsepower	2,660

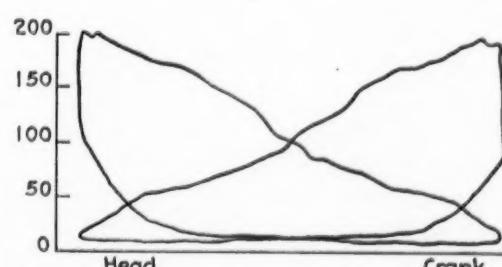


Fig. 5

Piston speed, ft. per min.	1,041
Cut-off, per cent	38
Boiler pressure, lb. per sq. in.	237
Mean effective pressure, head end, lb. per sq. in.	91.3
Mean effective pressure, crank end, lb. per sq. in.	92.3
Horsepower, right side	1,629
Total engine horsepower	3,258

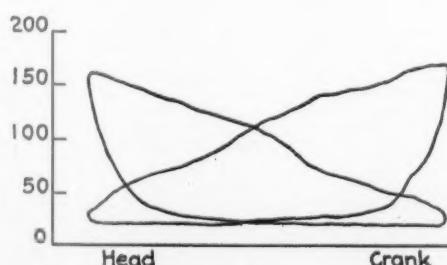


Fig. 3

Piston speed, ft. per min.	991
Cut-off, per cent	53
Boiler pressure, lb. per sq. in.	198
Mean effective pressure, head end, lb. per sq. in.	67.7
Mean effective pressure, crank end, lb. per sq. in.	76.8
Horsepower, right side	1,257
Total engine horsepower	2,514

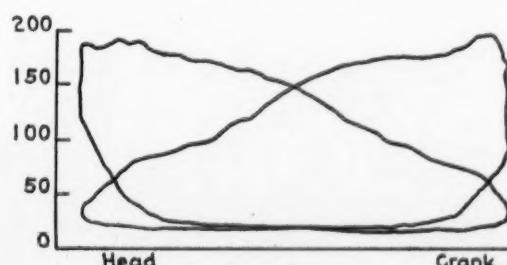


Fig. 6

Piston speed, ft. per min.	1,016
Cut-off, per cent	52
Boiler pressure, lb. per sq. in.	237
Mean effective pressure, head end, lb. per sq. in.	111.5
Mean effective pressure, crank end, lb. per sq. in.	115.0
Horsepower, right side	1,960
Total engine horsepower	3,920

construction with working pressures within the higher pressure range, one might be inclined to the thought that the 200 to 225 lb. per sq. in. working pressure to which many of the locomotives built in the 1919 to 1929 period are limited, presents an extreme handicap to one attempting to provide increased economy and power with which to meet today's operating requirements.

From the economy viewpoint, some encouragement

may be obtained from a review of the design of the recently built high-pressure locomotives. The adoption of the higher working pressures without modification of design to provide for increased ratio of expansion does not admit of the increase in thermal efficiency of the engine which is ordinarily considered a result of the use of the higher pressure. The decrease in the differential between the two is particularly true where a heavy work

rate with reduced ratio of expansion is involved, the locomotives in both pressure ranges working at approximately the same cut-off or with the same ratio of expansion.

High pressure is forced at times where high piston thrust is required, and the cylinder diameter must be limited to keep within clearance limits. There is no denying that high pressure gives an engine a "smartness" of response; however, from the standpoint of capacity and for operation within the present operating requirements of high-speed freight service, much may be accomplished with working pressures of 200 to 225 lb. per sq. in. An example of this is where the two groups of 4-8-2 type locomotives listed in example No. 3 of Table V are in a pool. The steaming capacity of the locomotives in the two groups is approximately the same. The 250-lb. locomotives have 54 Type HA superheater units with 61.6 sq. in. of steam area through them. The size of the valves, events, etc., are given in Table V.

When it was decided to condition the group of locomotives having 210 lb. per sq. in. to work in a pool with the 250-lb. locomotives, the 5½-in. flues were increased from 45 to 53, with a resulting increase in steam area through the superheater units from 51.3 to 71.8 sq. in.; the dry pipe and branch pipes were increased to suit; 29-in. cylinders having 13-in. valves were replaced with 29-in. cylinders having 15-in. valves; valve gears providing 6½-in. maximum travel were replaced with gears providing 8½-in. maximum travel; valves having 1-in. steam lap were replaced with valves having 1½-in. steam lap. There is some difference in the response of the two groups, so far as the enginemen are concerned, but none, so far as the dispatchers are concerned, both handling the same tonnage on the same schedules.

Steaming Capacity-Value of Feedwater Heating

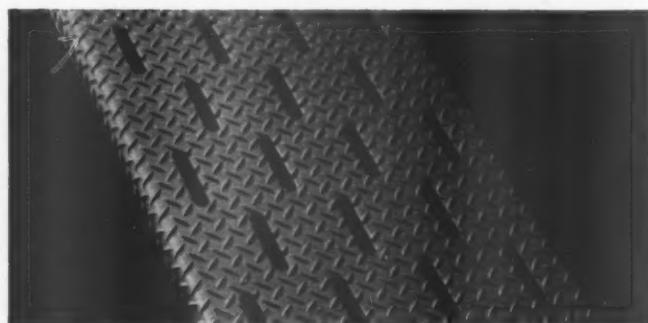
When treating the subject of providing the maximum possible capacity in existing steam locomotives, the steaming capacity which may be added to the boiler at high work rates by the application of feedwater-heating equipment, utilizing exhaust steam, should be analyzed and a distinction made between the percentage of return on the investment and the percentage increase in power; also that a net 10 per cent increase in boiler capacity is 12 to 13 per cent at the drawbar.

Conclusion

The groups of locomotives that were built in the years 1919 to 1930 offer in general, a fertile field for a substantial addition to the work-rate capacity of our locomotives through the adoption of a policy of providing proportions to give a high degree of superheat, low pressure drop from boiler to steam chest, and valve events to conform with present-day operating requirements, these changes building up the mean effective pressure at the higher work rates without increasing the maximum stress in frames, driving axles, crankpins, rods, etc.

Slotted-Type Steel Running Boards

A section of the patented A. W. slotted-type steel running boards, developed by the Alan Wood Steel Company, Conshohocken, Pa., for railroad use, is shown in the illustration. These running boards are made from



The Alan Wood super-diamond steel running boards of hand-hold size are slotted for extra security

solid-steel plate to minimize the possibilities of corrosion and to give maximum service during the life of the car. The slots are of hand-hold size for extra security and the arrangement of these slots is designed to insure additional protection against dangerous falling accidents.

* * *



Plymouth 30-ton Diesel locomotive with Caterpillar engine at work on the Atlantic & Eastern Carolina

EDITORIALS

Air Conditioning— Asset or Liability?

A number of passengers on a well-known long-distance train of modern equipment were subjected to serious discomfort and possibly had their health placed in some jeopardy by failure of the air-conditioning controls in the car which they occupied, resulting in a temperature of 55 deg. F. throughout most of the trip. In spite of repeated efforts of the train crew to remedy the difficulty, the condition was not corrected and one of the passengers was heard to remark that he would not ride that train again even if he had no fare to pay. On another recent occasion, a passenger complained of drafts in the car in which he was riding to which the porter mumbled some half-audible explanation. On repetition of the complaint a short time later, the porter said "Yo is just unfortunate, suh, in having a seat under that outlet!" In still a third case, a passenger entered an air-conditioned coach of somewhat ancient vintage in a local train and noticed a very definite and objectionable smell of tobacco smoke, body odors and stale air. His unfavorable reaction was in no way diminished by the fact that, after being in the car for half an hour or so, he became accustomed to this condition and his sense of smell no longer rebelled.

Without in any way minimizing the tremendous achievement of the railroads in applying modern air-conditioning equipment to such a large proportion of their principal passenger trains, it seems apparent that further efforts must be made: (1) to install equipment which will produce desired results and be positively trouble free insofar as practicable; (2) to develop a maintenance force and methods of inspection and maintenance designed to assure maximum reliability of operation; and (3) to instruct train crews in the proper handling of the air-conditioning controls and, possibly of equal importance, teach them how to treat passengers and what to do for them in any of the various contingencies which may arise.

Unquestionably, the great majority of air-conditioning equipment now in service in railway passenger cars functions with general satisfaction. It makes riding under severe temperature conditions, whether of heat or cold, much more tolerable than ever before and gives passengers a service under these conditions which can usually be secured in no other transportation vehicle. While no figures appear to be immediately available regarding failures of air-conditioning equipment, expressed as inoperative air-conditioning car-miles divided by total air-conditioned car-miles, the indications are that this is a pretty sizable percentage. Unless railroads, therefore, are on the alert to detect quickly

and correct all conditions which tend to prevent air-conditioning apparatus from functioning as intended, there is danger that this modern appliance, designed to attract passenger traffic to the rails, may become to an increasing extent less of an asset and more of an actual liability.

Proper Car Inspection To Reduce Train Delays

In discussing the relation of car inspection to train delays at the last annual meeting of the American Association of Railroad Superintendents in Chicago, the differences between Class A and Class B inspection were explained, the Class A consisting of a thorough inspection of all parts of cars before loading to make sure that the cars will carry their loads to destination without loss, damage or delay due to failure of any part as the result of existing defective parts.

Class A inspection requires careful examination of wheels, truck sides, bolsters, truck and body center plates, side-bearing clearances, sills and underframe. Couplers, knuckles, knuckle locks, lock set and anti-creep must be working properly and within specified limits of wear and contour, and couplers must be adjusted to the proper heights. Draft gears must be examined for slack, and stops, yokes, draft keys inspected, as well as all safety appliances. On box-type cars, the condition of floors, sides, ends, roofs and doors must be ascertained. Running boards and roof hand-holds must be in first class condition. On open-top cars, the condition of floors, sides, ends, doors and door locking mechanism must be ascertained.

Class B inspection, on the other hand, is a general and careful observation of cars to detect defects that might have developed after receiving the last inspection, special attention being given to trucks and safety appliances. While car inspection methods deviate in some details on various railroads, it is obvious that general inspection standards should be maintained as uniform as possible, with more attention paid to inspection for commodity classification. Any care exercised to assure the mechanical fitness of cars to meet the requirements of general service, as well as particular loads, is bound to show large returns in reduced train delays and attendant operating expense.

For example, some roads make a Class A, or 100 per cent inspection, at every terminal, while other roads make the Class A inspection at the originating point, and a Class B, or running inspection, at passing terminals, the latter, of course, being used more ex-

tensively by roads that are able to operate main-track freight trains. A car that has been given a 100 per cent inspection, with the boxes properly packed and oiled, at the originating point will travel to its destination without further servicing, whether the distance be 500 or more miles.

On some roads, where coal is the predominating commodity, the loaded cars are given Class A inspection at the first classification yard where the cars are assembled or classified for trains for movement over more than one division. They are given a Class B inspection at intermediate terminals, and are run a distance of 230 miles or more, where they are delivered to connecting lines. It is only rarely that a car is cut out of these trains while en route. These roads, in handling fast freight, use the same method of inspection; however, they are not quite so successful in improving the cut-out bad-order situation as they are on the coal trains, due primarily to the fact that foreign cars are handled which are not maintained to the same standard.

These facts are mentioned to bring out the point that were each individual railroad to have the same standard or system of maintenance of equipment, it would be possible to move loaded cars from the Atlantic to the Pacific, and from the Great Lakes to the Gulf of Mexico, without the necessity of bad ordering cars, except for certain defects which develop in transit. A good inspection before the car is loaded will show whether or not the car is in condition to take the load to its destination and, if not, what must be done to place it in condition for satisfactory service. Every time a loaded car is cut out in bad order at a terminal it means a delay to that car, and if the train is held for repairs to be made to the car it will cause serious delays to other cars.

Another Aspect of Defense Transportation

In these columns last month were discussed several phases of the freight-transportation problem likely to arise as the result of the large-scale program for national defense on which the nation is now entering. This had to do with the material aspect of the program. It is now evident that we will soon hear more about the personnel aspect of the program when Congress has taken final action on the various proposals for compulsory military training, National Guard mobilization and reserve officer mobilization which are now before it. Whatever immediate action it takes, it is evident that ultimately we shall have to provide for the movement of draftees to training camps and, if worse comes to worst, for the mobilization of troops in armies at strategic points for the defense of the territory of the United States.

During the fourteen months up to November 1, 1918, the movement of troops of all kinds for the War

Department amounted to an estimated total of 4,440,000,000 passenger miles. This was 8.6 per cent of the total passenger mileage for the period which was estimated at 51,500,000,000. About one-quarter of the military passenger miles were produced in the movement of drafted men to training camps and three-quarters in movements intercamp and from camps to embarkation points. From May, 1917, until the armistice in November, 1918, the entire training and mobilization period, the average monthly movement of troops amounted to about 503,000, with a maximum of 1,147,000 in July, 1918.

This was the movement required to create and embark an army of two million men. It required a total transportation of upwards of 8,700,000 men, involving 222,500 passenger-train car trips and 16,300 freight-train car trips in 16,500 trains.

These car requirements are the totals for a period of 18 months. About one-eighth of the total, however, was concentrated in the peak month. The same monthly peak load added to the 1938 passenger movement would represent an increase of more than 50 per cent in passenger miles but, owing to the greater average number of persons per car, the increase in passenger-car miles would probably not greatly exceed 12 per cent.

This can be considered only a rough approximation inasmuch as the average amount of mechanical equipment to be moved per man has increased materially under present conditions as compared with those prevailing at the time of the World War. It will also have to be corrected for whatever increase in the proportion of the total movement there may be on the highways. And it must be remembered that this was the peak month in the mobilization of an army of two million men following the declaration of war. As far as can be seen at the present time, the initial mobilization will be considerably less than two million and probably will be pushed much less intensively until we become directly involved in the conflict. Furthermore, until there is actual warfare, the movement will be confined to the collecting of men in training camps and this accounted for only about one-quarter of the total military passenger miles created by the training and embarkation of our World War army.

One Form of Training For Locomotive Supervisors

When a nation prepares to defend itself against a coming struggle there are certain steps that must be taken, under intelligent leadership, before any real program of defense plans can be carried out. Funds must be appropriated and expended, and officers and men enlisted and trained and equipment built and maintained in service. Until these things are done there is no defense and when they are done an adequate defense exists only as long as the plan of action is perpetuated.

On the railroads of the United States there are several "armies of defense"; those who operate and maintain the locomotives, cars, shops and enginehouses. The largest of these is that group of men whose duty it is to provide the motive power that moves trains. It may be interesting, at a time when the nation is talking and thinking about man power and equipment, to record the fact that the locomotive departments are responsible for some 43,000 steam locomotives, 800 Diesel locomotives and 770 electric locomotives; that in order to do the job with which they are confronted the "army" is in command of more than 2,000 key men and an "enlisted personnel" of approximately 150,000 men; that, in the year 1939 it spent \$263,000,000 for repairs to locomotives—and \$487,000,000 more was spent for wages fuel and supplies to operate them.

Outside of the general officers on the various roads the principal supervisors in the locomotive department are in the following classifications: superintendent of shops, master mechanic, mechanical engineer, shop engineer, supervisor of shop machinery and tools, assistant shop superintendent, general foreman of locomotive repairs, general enginehouse foreman and supervisor of apprentices. These are the key men—approximately 2,000 of them—upon whom falls the burden of the responsibility of carrying out the details of the policies and plans for the spending of 263 million dollars a year—an average of \$130,000 a year per man. How well are they trained for such a job?

One of the remarkable things about the railroad industry is the loyalty and efficiency of supervisory organizations that have grown up into the jobs they occupy by way of the hard road of experience and long hours. Railroad management, particularly in the past 10 years, has made little or no special effort to provide a systematic course of training for the men who are the backbone of its army of defense but, in spite of many handicaps the supervisory organizations have come through thus far with an enviable record and again stand ready for any duty that the future may bring.

In the absence of regularly organized training courses for supervisory personnel there is available a means of supplying the deficiencies that may now exist in the broadening education of these key men in matters pertaining to the most expensive operation in the railroad job—locomotive maintenance. That means is the influence of membership and committee work in an association the objectives of which are the advancement of knowledge contributing to increased efficiency in the field of loco-repair work. The Locomotive Maintenance Officers' Association is such an organization and the progress that has been made by that small group of officers and "charter" members in bringing the association up to the standard of program and attendance that it attained last October is deserving of the support of every railroad supervisor eligible for membership, and of every general mechanical officer within whose jurisdiction rests the authority to send his supervisors to the meetings of the association.

Rapidly changing events have driven home to us as never before the value of unified action in order that the individual abilities of men may be used collectively toward a common end and associations such as this provide the means of acquainting a membership scattered over the entire country with the objectives that are so important in fitting it into the defense plan.

New Books

TURRET LATHE OPERATOR'S MANUAL. Published by the Warner & Swasey Company, Cleveland, Ohio. 240 pages, illustrated. 7 in. by 10 in., bound in cloth. Price, \$2.50.

This book is published to serve as an instruction manual for the training of turret-lathe operators and to enable present operators to improve their operating technique, the quality of their work and to do the job with greater efficiency. It is written expressly for the shop man and the text is supplemented by over 350 illustrations and drawings. The manual contains 25 chapters which are grouped so as to present a classification and description of the types of turret lathes and their equipment; a descriptive analysis of the operations which they perform; the special fixtures and tooling equipment used; the principles of turret-lathe tooling; examples of bar and chucking work; a chapter on the principles involved in estimating production and a data section containing such information as is usually needed by operators of this type of machine. Having absorbed the information in the first 18 chapters of this manual the railroad-shop operator of a turret lathe will recognize in the next five chapters—those dealing with bar and chucking equipment and problems and special tools—many of the answers to specific questions on railroad operations which come up in the course of a day's work. A study of this manual by operators and supervisors of machine work can hardly fail to result in getting more out of the equipment they use.

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE. Sixth Edition. Published by the Lincoln Electric Company, 12818 Coit Road, Cleveland, Ohio. 1,125 pages, illustrated. 5 3/4 in. by 9 in., bound in simulated leather. Price, \$1.50.

The eight sections of the handbook cover Welding Methods and Equipment; Technique of Welding; Procedures, Speeds and Costs for Welding Mild Steel; Structure and Properties of Weld Metal; Weldability of Metals; Designing for Arc-Welded Steel Construction of Machinery; Designing for Arc-Welded Structures, and Typical Applications of Arc Welding in Manufacturing, Construction and Maintenance. Several pages of the latter section are devoted to railroad equipment. While some of the applications therein described cannot be recommended as good practice, possibilities of the use of arc welding in the railroad shop are suggested.

Lehigh Valley Converts

Hopper Cars for Cement



DURING the month of May the Lehigh Valley started a program calling for the conversion of 25 hopper cars of 70 tons capacity to covered hoppers of the same weight capacity for the handling of cement and similar commodities. The first of the converted cars came off the assembly line at the Sayre, Pa., shops and was turned over for service during the week ending May 18.

The original cars, as they come to the shop for re-building, were similar in design to those described in an article in *Railway Mechanical Engineer* for October, 1938, page 392. That article described the processes involved in the cutting down of the cars from hoppers of 70 tons capacity to 50 tons capacity. In that case 11 ft. 8 in. were cut out of the center of the car and the shortened car was welded and riveted together to form a finished car having a light weight of 40,600 lb. and a

Principal Dimensions and Weights of the Lehigh Valley Cement Hopper Cars

Series	Series	Series
50,000-	50,100-	50,150-
50,089	50,149	50,174
Length over strikers, ft.-in.	31-6	41-6
Length, inside, ft.-in.	30-0	31-7½
Width inside, ft.-in.	9-5½	9-6¾
Width overall, ft.-in.	10-0¾	10-2
Height rail to top of side plate, ft.-in.	10-3½/16	10-6
Center to center of trucks, ft.-in.	21-9	31-6
Truck wheel base, ft.-in.	5-6	5-8
Capacity, lb.	100,000	140,000
Capacity, cu. ft.	1,393	1,933
Load limit, lb.	124,500	153,900
Light weight, lb.	44,500	56,100
Ratio revenue to gross load, per cent.	95.1	106.7
Ratio revenue to load to tare weight, per cent...	266	292
		286

NOTE:—Based on 85 lb. per cu. ft. weight of cement.



Preparatory to shortening the car's side panels are removed and a center sill section is cut out—The ends are supported on a dolly

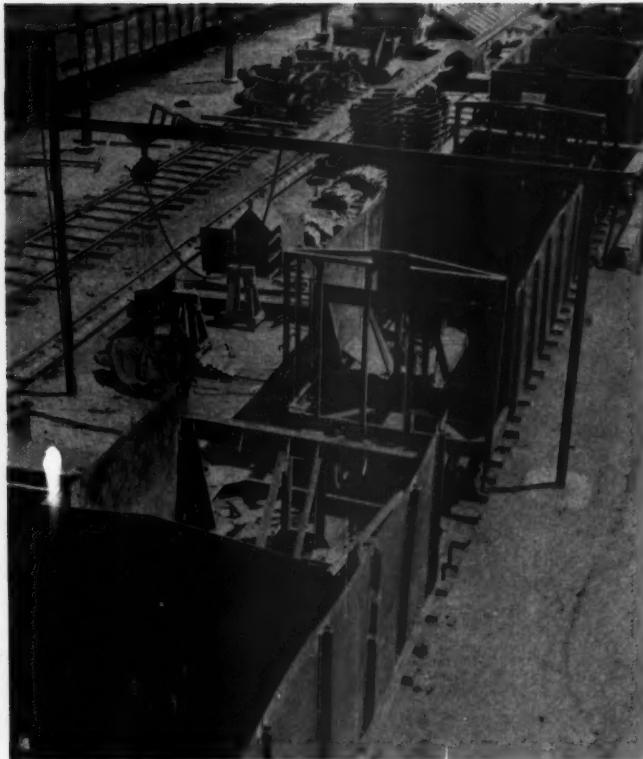


The method of supporting the car ends is shown—The workman is cutting out the side sill section before pushing the ends together



This and the following six photos were taken from the overhead crane
The car is ready for removing panels and cutting sills

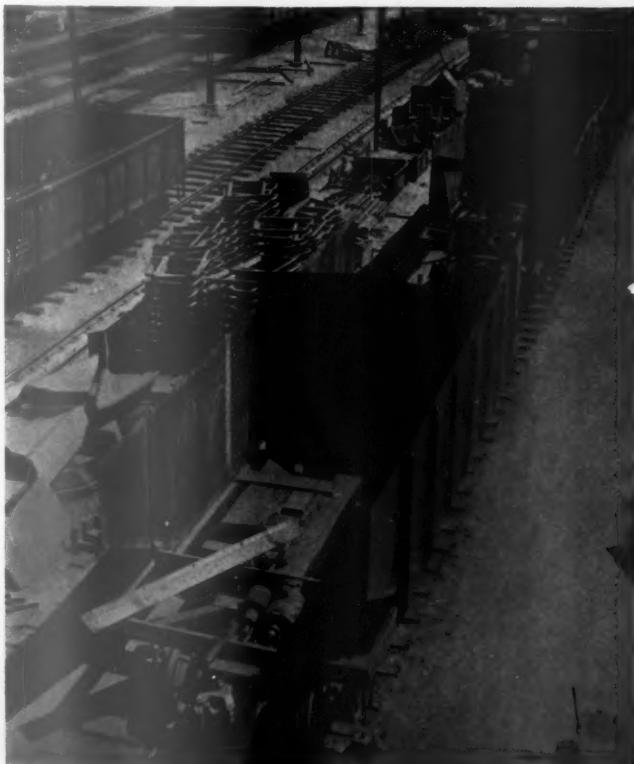
cubic capacity of 1,928 cu. ft. In the rebuilt car for cement service, described in this article, 8 ft. 0½-in. is cut from the center of the old car, shortening the overall length of the car to 33 ft. 5½ in., over the striking plates, and 23 ft. 5½ in. truck centers. These cars are of the former 40,000 series and the rebuilt cars are be-



Here the cars have moved along the assembly line to the position where the end framing is applied by the aid of an overhead hoist

ing numbered from 50,175. The cubic capacity of the cement cars is 1,790 cu. ft. and the light weight is 53,100 lb. The principal weight and dimensions of Lehigh Valley cement cars is shown in the table.

The rebuilding process is carried out in the open freight car heavy repair yard at the Lehigh Valley's

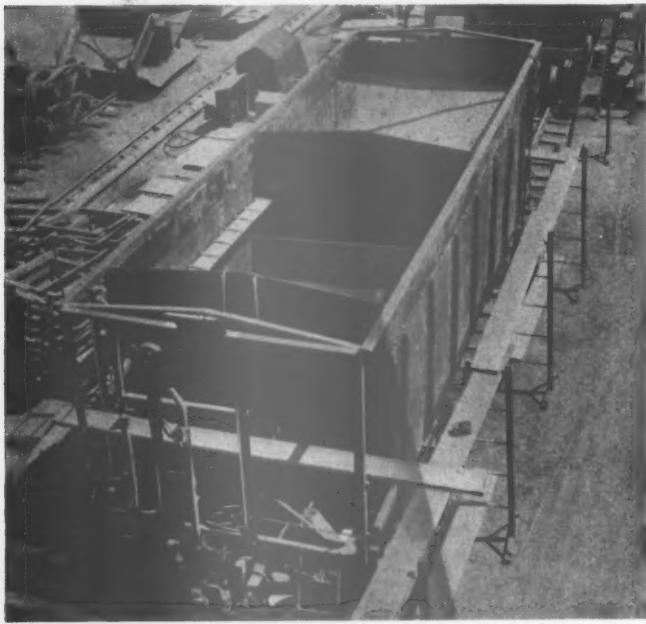


At this position the center partitions have been installed and the straightened side stakes have been returned and applied to the car



The 21-inch extension has been added to increase the height of the car, the top side and end bulb angles and slope sheets applied

system shop at Sayre. Numerous improvements in repair facilities have been made at this point during the past two years such as the equipment of the yard with a 100-ft. gantry crane on a 700-ft. runway, the piping of the working area for acetylene and the installation of electric welding circuits with a central motor-driven welding generator set. A comparison of the illustrations accompanying this article with those appearing in connection with the article describing the converted hoppers previously mentioned will reveal the greatly improved facilities which now permit greater output.

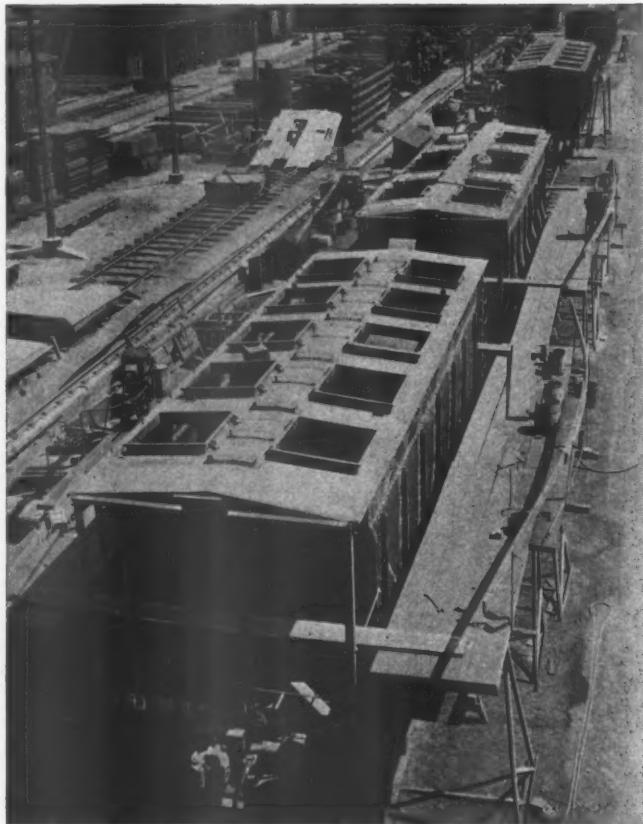


Couplers, draft gear and hand brake have been applied

In the rebuilding operations the old cars are brought into the north end of the repair yard and move in a straight line, on the same track, toward completion. In the stripping position all of the burning is done with acetylene torches to remove the rivets from the bulb angles, slope sheets, hoppers, and side and end sheets. In this position the necessary burning is done to remove the two side sheet panels, one from each side of the car, preparatory to cutting out the 8 ft. $0\frac{1}{2}$ in. from the center of the car. On one side of the car one sheet is removed from the center toward the "A" end of the car and on the other side one sheet is removed from the center toward the "B" end of the car. Thus, in the completed car the cutting and splicing of the side members has been done diagonally across the car.

After the burning has been completed all of the parts above mentioned are broken out and disposed of and the cars are sent to be sandblasted, after which they are given a coat of rust preventative before they are returned to the rebuilding tracks.

The next job that is necessary is the cutting of the center and side sills. This is done with the torch and the center sill cutting is done with the aid of a jig to facilitate the channels being cut accurately. The side members are cut out between the side sheet panels that remain after two panels on each side have been removed. One of the illustrations shows how the center sill ends are supported with one fixed and one movable support before the section is cut out. After the cutting is finished the ends of the center and side members are chamfered, by grinding, preparatory to the welding operations involved in the splicing. The end of the car



The roofs with hatch openings have been put on and seal welded

to which is attached the movable support is then pushed ahead until the cut-out section is closed in and the splice plates are welded on the center sill channels, the center sill cover plate is fastened down and the splice plates are welded to the side sills.

During the stripping operation it is often necessary to remove some of the original pressed steel side stakes and have them straightened. It is at this stage of the rebuilding job that these are returned and replaced on



Here the hatch covers and locks are on and the car is ready to paint



The hatch covers are made on jigs—These jigs are used in a vertical position which facilitates the drilling and reaming



After the roof is completed on one of the two roof jigs it is lifted over to the assembly line by overhead crane and this fixture

the shortened cars, two of these side stakes forming the splicing members for the side sheets on either side of the car. It is of interest, at this point, to call attention to the fact that a 21-in. extension is added to the top of the car sides to increase the height. At this stage, before this extension is added, there are seven of the original side stakes on each side of the car and these end at the top of the original side sheets. These original side stakes are later extended and new side stakes added at the time the extension is applied.

The cars are now moved to the next position where the center partition is installed and the bolster reinforcing plates are welded on. At this position the reinforcing angles for the slope sheets and cross ridge sheets are applied and following this the supports for the slope sheets and hopper sheets are installed. At this same position the hopper door frames and doors are secured to the hopper sheets and made ready for the welding operations that seal up the joints around the door frames.

The "A" and "B" ends of the cars are made on jigs at an adjacent location and are now brought to the building track and applied to the cars. At the same position the bulb angles at the ends of the cars are applied.

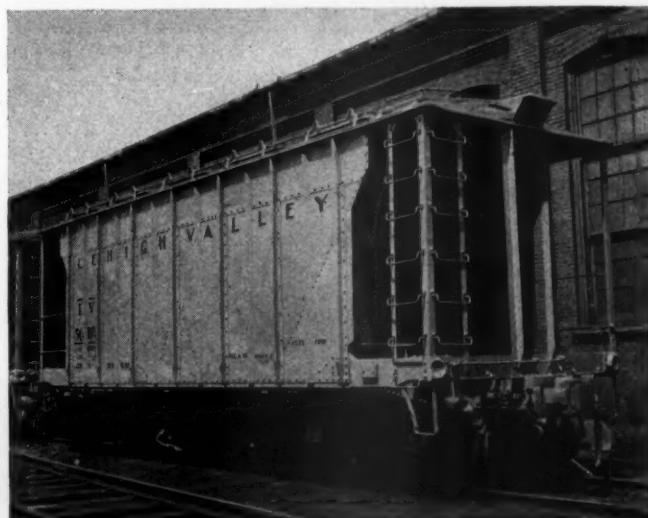
In the next position the extension at the tops of the car are placed and riveted to the original side sheets and the top side bulb angles are put on, reamed and riveted to the side sheet extensions and to the car ends. The four slope sheets are installed and tack welded in place.

The cars are now moved to the next position, the roofs are lifted over from the roof jigs to the assembly line and placed in the cars, where they are fitted and reamed preparatory to riveting up. In the next position the hatch covers, cover locking devices and runboards are applied and the cars move to the position where the welding is done. Here the seams between the roof and the sides and ends are welded; all of the inside seams are welded, electrically; the seam between the original side sheets and the top extensions are welded; new pressed steel intermediate side stakes are welded onto the outside of the side sheets between the original side stakes and the extensions to the original side stakes are welded on. At this position the hopper door frame joints are welded to provide sealed hoppers.

Jigs are utilized to assemble the car ends, roofs and hatch covers. Two roof jigs have been installed adja-

cent to the assembly track. One of these jigs is used for fitting up a roof while the finishing work is being done on the other jig. The jig for the hatch covers is used for the application of the hinges. The hatch cover locking device, consisting of a long round bar supported in bearings, is made on a hydraulic press in the blacksmith shop. When the handles are in the closed position they are secured by handle locks and the two bent projections in the bar bear on each of the hatch covers and hold them in place.

The cars reach the truck repair position with the original trucks. The old trucks are removed adjacent to an



The first of the rebuilt cars is completed ready for service

elevated truck-repair track and trucks that have been overhauled are placed under the cars. When the cars reach this position the draft gear, couplers and brake equipment have been applied and the cars are then given a thorough water test before they are moved on to the painting position.

After the cars are dry a second coat of rust preventative is sprayed on and this is followed by two coats of battleship gray paint. The lettering on the cars is done in black by the brush method.

Wheel Stick Designed To Eliminate Journal Damage

Although the wheel stick is employed in most railroad shops in the handling of mounted wheels, it is a tool that can cause considerable damage to the journals if not properly designed and used. For this reason considerable study was given to the design of the wheel stick shown in the illustration. It consists of a long wooden handle with a steel frame fitted to its lower end having a single steel rod projecting about 6 in. below the end of the handle. Between the side plates of the steel frame are two rollers of sufficient width to allow the end collar of the axle to drop down between the side plates and rest on the roller surfaces.

In handling wheels, the stick is hooked under the end collar, allowing the collar to rotate on the rollers. This eliminates any damage that might be caused by the use of a wheel stick under the journal.



The wheel stick is hooked under the end collar

Bucking Bar for Steel Car Work

A convenient type of bucking bar, known as the 9-bar, because of its similarity to the figure nine, is shown in various stages of manufacture in the illustration. The

Farlow draft-gear link shown in the foreground is cut into two parts, as illustrated, and a small piece cut out near each end, so that from one Farlow link two pieces of steel are secured which have roughly the desired shape of the bucking bar. Two completed bars with rivet headers formed on one end and the handle end drawn out slightly at the other, may be seen in the background of the illustration.

This type of bucking bar is well designed for use in applying pressure to the head of a rivet inserted through relatively thin steel sheets. The short straight arm of the bucking bar, in line with the handle, is simply placed over the two steel sheets or shapes to be riveted together and the header forces the rivet through from the other side. On account of the large leverage, relatively little pressure on the handle of the bar will pull the sheets together and hold the rivet head securely while it is being upset with an air hammer. This bucking bar is light in weight, easy to handle and can be used to advantage in close quarters. It can be readily designed and forged to any desired shape, dependent upon the special requirements of individual bucking jobs.

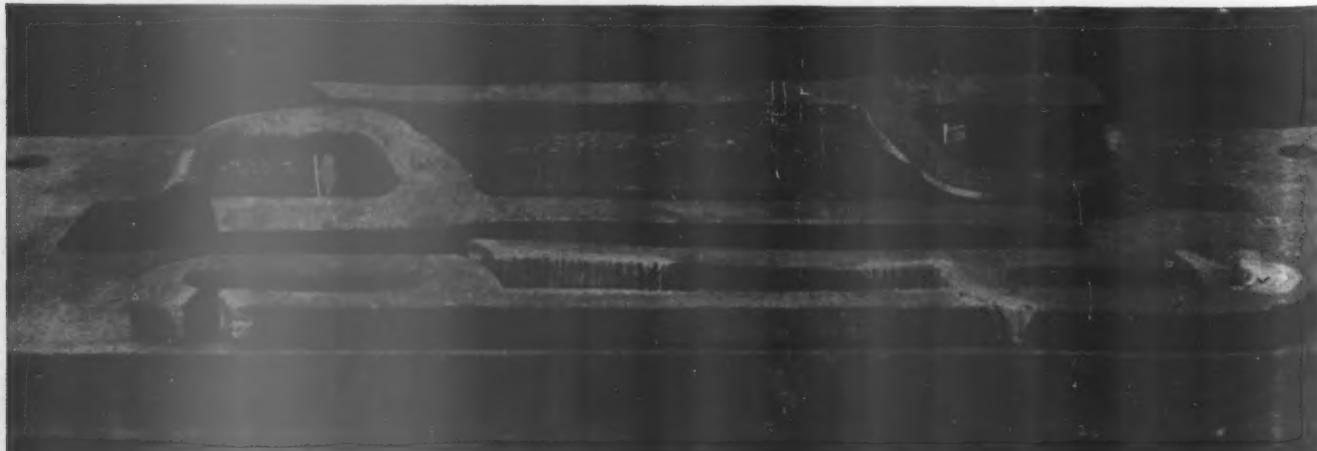
Air Brake Questions and Answers

D-22-A Passenger Control Valve (Continued)

585—*Q.—How should the piston ring and bushing be lubricated?* A.—Before the cleaned piston is replaced in the bushing press the side of the packing ring opposite the scarf to the bottom of the groove, then introduce three drops of approved triple valve oil in the groove through the scarf opening, after which restore the ring to its normal position and carefully rotate it in its groove to distribute the oil. Next, place three drops of the triple valve oil in the bushing and distribute it over the entire surface in a manner to avoid introducing dirt or other grit. Then insert the piston and slide valve in the body, leaving them in release position, after which place three drops of triple valve oil in the cylinder bushing and again distribute it on the bushing surface as previously described.

586—*Q.—What do the preceding instructions also apply to?* A.—The release piston and its slide valve.

587—*Q.—How should the emergency portion be cleaned and lubricated?* A.—When the emergency portion is to be dismantled and cleaned, the main piston cannot be removed without first removing the upper



Two bucking bars made from a scrap Farlow draft-gear link

cover and taking out the diaphragm strut, which serves to hold the slide valve to its seat. Damage will result if force is used to remove the emergency piston from its bushing without first removing the diaphragm strut. The spring behind the emergency vent valve is held in place by a circular sheet metal retainer which has lugs on two opposite sides. These lugs engage under a lip around the outer end of the cavities in the body casting. To remove the spring and valve, press down on the spring retainer and tilt it so that one lug is exposed upward. When in this position, the parts can be readily removed and they can be re-assembled by the same method. The individual parts of the emergency portion, such as pistons, rings, valves, springs, and gaskets, must be cleaned and inspected in the same manner as was specified for similar parts of the service portion.

588.—*Q.—How can the type UA brake cylinder be lubricated without dismantling?* A.—Remove the upper $\frac{1}{8}$ -in. pipe plug from the pressure end of the cylinder. Attach an approved pressure gun to the connection and inject about $2\frac{1}{2}$ cu. in. of brake cylinder lubricant. Replace the $\frac{1}{8}$ -in. pipe plug at the outer end of the non-pressure head. Attach the pressure gun and inject about $1\frac{1}{4}$ cu. in. of brake cylinder lubricant, which will lubricate the piston rod bearing and dirt protection seal in the non-pressure head. Replace the $\frac{1}{8}$ -in. pipe plug.

589.—*Q.—When should the brake cylinder be dismantled for inspection, cleaning, repair and lubrication?* A.—At the periodical cleaning period for the equipment or when the cylinder has been lubricated by means of a pressure gun and check test shows objectionable leakage.

590.—*Q.—What is the method recommended for cleaning and lubricating when the brake cylinder is to be dismantled?* A.—It is recommended that cleaning and reconditioning the piston and non-pressure head assembly be done in a clean room where special tools for this purpose are available, and the work can be done without possibility of damage to the parts which might occur if this work is attempted at the car. Protection against dirt should be provided during the movement of these parts from the repair shop to the car, and care exercised to keep dirt from the piston when applying it to the cylinder.

591.—*Q.—How should the packing cup be removed and cleaned?* A.—Remove the packing cup by using a wooden tool about 1 in. wide and $3/32$ in. thick or equivalent, having rounded edges to prevent damage to the packing cup and the piston lubricator. The packing cup should be thoroughly cleaned with an approved solvent to aid in removing the oil, grease, and dirt, then inspect for cracks, damage or worn out condition.

592.—*Q.—How should the piston lubricator and its swab be cleaned?* A.—The piston lubricator with its swab should be cleaned without removing the felt from the ring, submerging the ring in a tank of specified solvent for a few minutes, then loosen the felt in its groove with a thin rounded-edge blade, after which the ring should again be immersed in the solvent for a time sufficient to dissolve the grease from the felt. Brushing the outer surface of the felt with an ordinary hand brush will aid in removing the old grease and clean the surface of the felt. The felt should then be dried with a jet of air.

593.—*Q.—When and how should a new lubricating felt be applied?* A.—When the felt of the piston lubricator is damaged, worn out, or in such a condition that it cannot be loosened and raised in its groove so as to make full contact in a ring gage which should be provided for this purpose, the felt must be removed and replaced by a felt in good condition. Next, submerge the assembled felt retainer ring in a tank of specified oil, the tank being of sufficient depth to cover a number

of these assemblies. The felt retainer ring should be soaked in oil for at least 10 minutes and allowed to drain for the same period of time. The object of this operation is to saturate the felt and thereby prevent it from absorbing oil from the brake cylinder lubricant. The felt retainer ring is now ready for application to the piston.

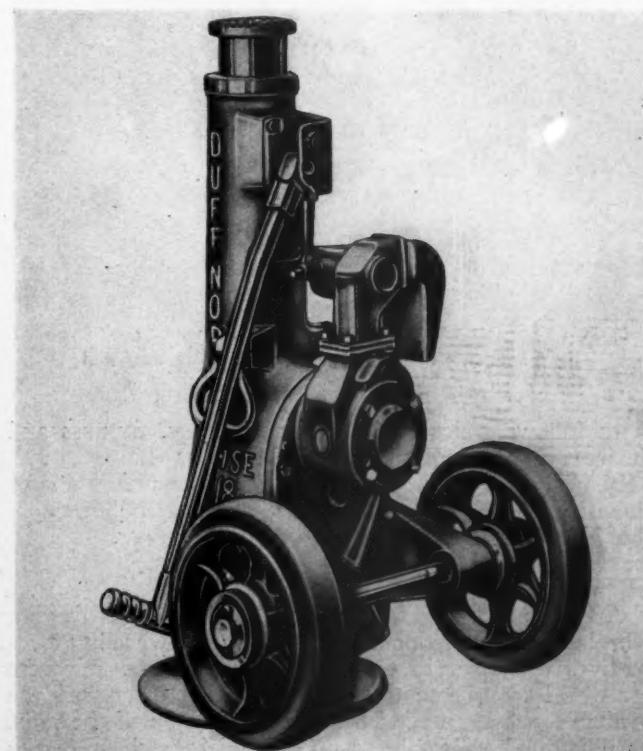
594.—*Q.—How should the piston lubricator assembly be applied to the piston head?* A.—To the piston with the flat (felt) side next to the piston.

595.—*Q.—What is the purpose of the side vent in the brake cylinder cut-out cock?* A.—With the cock closed, the side vent drains air pressure from the brake cylinder and the brake is positively released. This makes it possible to cut out the brake as covered by the previous answer without possibility of the cut-out brake "creeping on" for any reason. It also provides for safely changing brake shoes or adjusting piston travel.

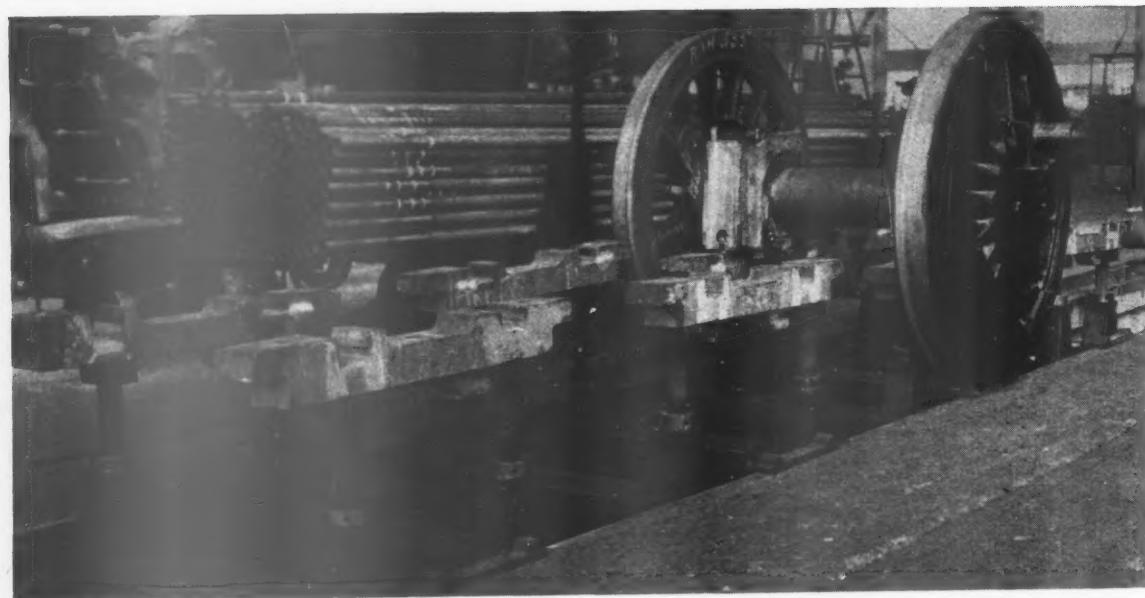
Motor-Operated Jack for Empty Freight-Car Work

A 20-ton jack, operated by a rotary air motor and designed for empty freight-car repair work, has been added to the line of jacks made by the Duff-Norton Manufacturing Co., Pittsburgh, Pa. By using two of these jacks, one man can raise and lower a car 18 in. in 4.3 minutes. When operating two jacks in this manner by using a Y-valve connection, the accurately timed lifts permit the car to be raised evenly up to the limit of 18 in.

The jack is mounted on roller-bearing wheels having rubber tires and is easy to move and place. As a safety feature, the motor is stopped automatically when the lifting standard reaches the safe limit of its raised or lowered position. The jack operates on standard shop air pressure.



The Duff-Norton 20-ton jack for empty freight-car repair work is operated by a rotary air motor

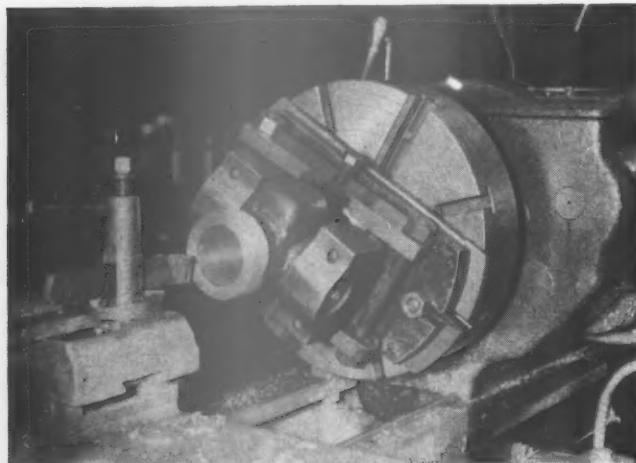


Equipment used in wheeling locomotives at Paducah shops

Paducah Shop

Jigs, Fixtures and Devices

By G. H. Raner*



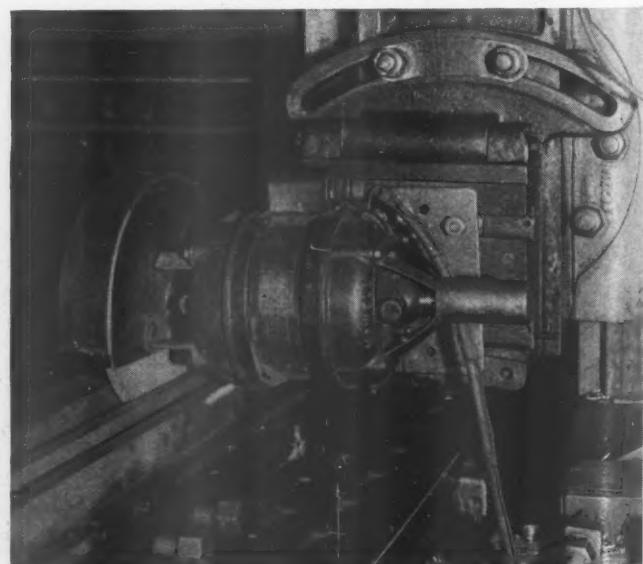
Jig for holding radius-bar guide while being machined

THE following description of special jigs, fixtures and devices now being successfully used at the Paducah (Ky.) locomotive shops of the Illinois Central is a continuation of an article on the same subject published in the June, 1940, *Railway Mechanical Engineer*.

Wheeling Locomotives

An arrangement for properly spacing all driving wheels, and supporting frame binders for wheeling locomotives is shown in one of the illustrations. Spacers for wheel arrangements of various classes of engines are available, the set needed being placed on top of the rails, as illustrated. Two holes are drilled in each spacer to receive pins which engage suitably spaced holes in the

track rails. The driving wheels rest on the spacers which definitely position them the correct distance apart and square with the track. The crossbeams for holding the binders are pieces of 12-in. channel iron, reinforced on the inside by a piece of flat iron welded in the channel and resting on the concrete ledge of the pit. The adjustable screws shown are 3 in. in diameter by 24 in. long, this height permitting adjustment to accommodate all classes of locomotives. It will be noted that the



Method of truing multiple-wear guides by grinding

* Assistant shop engineer, Illinois Central.

screws extend down through the cross channels and a key way in each adjusting screw prevents it from turning when raised or lowered by the round nut. The head is welded on top of the screw.

The driving wheels are placed on the spacers with boxes already applied. Frame binders are then placed on the fixtures and raised to a height to conform to the engine. Frame wedges are set in place on the driving boxes. Shoes are placed on the frame of the locomotive itself and held by set screws at the top of the flange on the inside. When all wheels are in place with binders and wedges set, the engine is lifted by an overhead crane and lowered down over the wheels. The jig arrangement is set by the adjustable screws to the proper height so that the weight of the locomotive forces the pedestal legs into the binder jaws.

Radius-Bar Guider Holder

The base of the jig for holding radius-bar guides while machining in an engine lathe is $\frac{3}{4}$ in. by 9 in. wide, being counterbored and made of such a length as to suit the machine chuck on which it is used. It is held in place on the chuck by two $\frac{7}{8}$ -in. T-bolts. Two removable caps are bolted to the base plate for holding the guide and there are also two removable clamps for adjusting the back end of the guide by means of set screws. This holding device is used for both turning and boring these radius-bar guides which are difficult to hold in an ordinary machine chuck, as they are only 10 in. long and somewhat irregular in shape. By the use of this jig, four of these parts may be completely machined in an eight-hour period, which is about four times the production possible by former methods of machining.

Truing Worn Multiple-Wear Guides

One of the devices illustrated is a 2-hp. motor and grinding wheel operating at 1,800 r. p. m. and attached to a Betts planer tool head for use in truing worn multiple-wear guides. The abrasive wheel used is a Norton

wheel made for grinding steel and is of a size most suitable for the particular operation of smooth finishing. The guide is held in place on the planer by a special fixture and the machine table moves at 20 ft. per min.

In the absence of such an arrangement for smoothly grinding multiple wear guides, it would be necessary to file and polish by hand; a slow and laborious operation.



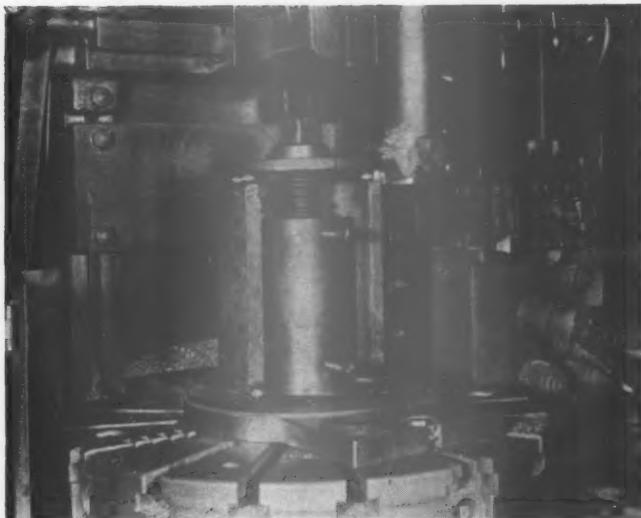
Rotary support for driving boxes and other locomotive parts while being welded

Multiple Drilling Operations

A Hoeffer multiple drill, which is used primarily for drilling brake- and spring-rigging pins, eight at a time,



Hoeffer eight-spindle machine for drilling brake- and spring-rigging pins



Jig for holding crown brasses on a Bullard vertical turret lathe while being machined

is illustrated. These pins are held in place by a special fixture, which serves to hold them while all holes are automatically drilled a correct distance from the head of the pin. When the drilling operation is completed on each lot of eight, they are automatically removed by an extractor, which is controlled by an air-operated 3-in. cylinder not visible in the illustration, but located on the opposite side of the machine and operated by a foot pedal. This serves to dump the eight pins in the pan in front of the machine. From thence they go into the skid box.

The supply of undrilled pins is carried in a hopper, where they move down by gravity within easy reach of the operator for placing in the machine. As many as 1,800 pins may be drilled by one operator in a period of eight hours.



Lift-truck and blocking arrangement used in moving driving wheels without danger of scoring the journals

Supporting Main Driving Boxes for Welding

Another illustration shows a revolving table or face plate used for supporting many locomotive parts while being welded, but primarily for welding hub liners to main driving-wheel boxes. The table consists of an old drill-press table mounted on a spindle with ball bearings, set in the shop floor and having a sheet metal top which supplies a smooth surface for supporting the work. This device is easily revolved by hand to whatever position is most convenient for the man who is doing the welding.

Holding Locomotive Brasses for Machining

The device for holding a locomotive crown brass while being machined consists of a base as illustrated, made of forged steel $1\frac{1}{2}$ in. by 15 in. in diameter and having



Air-operated door-opening device as used at Paducah shops

an extension fitting into the Bullard boring-mill table center which serves to hold the jig in alignment. The plate itself, as may be noted, is bolted to the table, one bolt on each side.

The cylindrical top leg of the jig is 6 in. in diameter and 10 in. high. It is welded to the base. In it are six set screws which are used for aligning the brass from the inside. The top plate, drawn down tightly by the top nut as shown, has three pointed set screws to assist in holding the brass firmly. Similar set screws in the base also serve for adjustment purposes and to secure the

(Continued on page 331)

Flock of Troubles



He sat down at the desk in the office and began thinking aloud

JOHN HARRIS, roundhouse clerk for the S. P. & W. at Plainville, was looking through the mail, sorting it out and laying it in three piles. In one stack he placed correspondence that didn't require an answer, in another was routine inquiries about reports, etc., that the clerk could answer, the third and smallest pile was composed of correspondence that required the personal attention of the foreman.

Harris opened an envelope and removed a single sheet of paper. At the top of the page was typed "monthly allowance for May." The clerk glanced at the figures, then read them carefully and still couldn't believe what he saw even after reading them aloud.

"Say, Mr. Evans," Harris called to the roundhouse foreman who was in the little office adjoining, "we got the allowance for May."

"Is it cut any?" Evans asked as he came into the main office.

"Is it cut!" Harris echoed with emphasis. "Look at that!"

The foreman took the sheet of paper and read the figures. "There must be some mistake. Maybe the master mechanic's stenographer got the decimal point in the wrong place."

"That's what I thought when I first looked at it," Harris said. "Then I read what it said down at the bottom of the page:

"On account of business on the railroad being very

by
Walt Wyre

bad through April and no prospects of improving, drastic reductions for May are necessary. No excuse will be accepted for running over the allowance. You will also arrange to store as many serviceable locomotives as possible in order to effect further savings. H. H. Carter, Master Mechanic."

"It can't be done," Evans said as he laid the letter on the desk, then added, "You might as well start working on a bulletin to reduce the force. I'm going to talk to the master mechanic."

Carter gave Evans very little consolation and no more money at all and that was that.

After the roundhouse force was reduced until the place looked like a government bureau office on Saturday afternoon, Evans started in to comply with the order to place as many serviceable engines in storage as possible.

The 5092 was a pretty good engine. She had just been off the drop pit a little over a month. Evans decided to place her in storage along with the 2714 that had a broken cylinder casting and the 2543 that was too small to handle the heavy trains on the Plains Division if it had been in condition to run.

Evans discovered that 5087, marked for 84, had a broken frame and would be due for a five-year test at the end of the next round trip so he stored the 5087 and ran the 5092 on 84. By the end of the month six 5000 locomotives were standing on the storage track but it is

very doubtful if any federal inspector would have classed one of the six engines as "safe and suitable for service."

One day in the latter part of May, the master mechanic was walking around the shops and went out to look at the stored engines. While there he saw Evans and called the foreman over.

"I thought I told you to store serviceable engines," the master mechanic said to Evans.

"Yes," Evans replied, "but I had to run a few trains and didn't have men enough to much more than keep the yard engines in shape."

"What are you going to do if business picks up?"

"I thought perhaps we might get a little more money for June, then I'd fix up a few extra engines."

The appropriation for June was increased a little, very little. "Maybe business won't pick up," the clerk said in an attempt to be consoling.

"It's certain not to get much worse," Evans replied, "and it's due to pick up. If it does get better soon, I'll sure be over a barrel." Evans took a fresh chew of horseshoe and went to the roundhouse.

"Say, Mr. Evans, the engineer that came in on the 5088 says the air pump is not any good," machinist Monroe said. "Do you want me to go into it? I've got to clean the air on two engines that are six-months tests," he added.

Evans hesitated a moment then said, "Maybe you'd better change the pump."

The machinist started at once taking the air pump loose. When the pump was about ready to lift off he told his helper to tell the portable crane operator.

"What do you want me to do with it?" the crane operator asked when the pump was lifted off.

"Take it to the storeroom," the machinist said, "and bring another pump back."

The crane operator hauled the defective pump to the storeroom, but he didn't bring another back for the simple reason that there wasn't any to bring.

"What do you want me to do now?" Monroe asked Evans.

"Take a pump off one of the stored engines," the foreman said, thus violating his own order not to rob any parts from stored engines.

THAT was just a beginning. The store department, evidently under orders to economize as much as possible, let the stock run down. The six stored engines became a secondary source of supply for running repair material until by the middle of the month every one of the 5000's on the storage track was minus some parts.

Business on the Plains Division didn't pick up—it jumped all in a bunch and with very little warnings.

One morning Evans came to work at seven o'clock as usual. The morning lineup showed the usual number of trains. He glanced through the mail and almost overlooked a traingram typed on a piece of yellow clip. Evans was too shocked to swear when he read the message.

Twenty trains of soldiers and equipment were to be moved over the S. P. & W., the message read. The trains were to be run two hours apart. The first train would reach Plainville about noon of the twenty-first. Evans looked at the calendar—just five days and five hours, that was what he thought until he read the next paragraph:

"The six 5000 class locomotives stored in Plainville will be placed in service and sent to Sanford to be used on these trains. These engines must reach Sanford not later than the morning of the twentieth," Evans read and felt like Joe Louis had hit him in the pit of the stomach. That meant the engines must be ready to run out of Plainville not later than ten o'clock the night of the

nineteenth. Four working days to get six extra engines and not enough men to handle running repairs!

Evans, still in a daze from the traingram, went to the roundhouse to line up the work for the men to start on at eight o'clock. After the whistle blew he went to the office and told the clerk to call in every available man that had been cut off and tell them to report for work at once.

Jenson, a machinist, was the only man that could come at once. He reported for work at 8:30.

"I want you to inspect the six stored engines," Evans told the machinist, "and make a list of all material required to get them in condition to run. No," he said, "just inspect five. The 5087 is due for a five-year test. No use trying to get her ready."

Two more machinists and two machinist helpers could come in at noon. Another machinist could report next morning. Two boilermakers and one boilermaker helper and a pipefitter were all that could be located. The rest of the cut off men were either out of town or working on jobs that they wouldn't quit for four or five days work on the railroad.

When Evans saw the list of material needed for the stored engines he almost swooned. It seemed that almost everything except frames and boilers were needed to put the engines in service.

"Is this all?" Evans asked the machinist.

"That's all that has been taken off. I didn't check bushings or anything for wear but wouldn't be surprised if some of them don't need renewing."

"I'll be surprised if they don't," Evans said as he started to the storeroom. "Wish you would check over this list of material and wire for passenger shipment on all you don't have in stock," the foreman said to the storekeeper.

The storekeeper looked at the list: one air pump, two feedwater pumps, one injector complete, two lubricators, a main rod. "You want me to have this stuff all shipped passenger?" the storekeeper almost exploded.

"No, just the part that you don't have in stock."

"Why, they'll run me off the railroad for life if I wire for all of that to be shipped passenger."

"They'll run me off if you don't," Evans said, "besides tying up about nineteen out of twenty trains that are scheduled to run four days from now. After you get through checking over that list, I'd like to see how you are fixed for brass bushings. Chances are we'll need to wire for some of them to be shipped along with this other material."

Evans was correct. The stock of brass in the storeroom was based on current consumption and short for that. Almost a ton of brass would be required in addition to that on hand in the next seven days.

The storekeeper dropped in a chair completely overcome. "It's absolutely impossible! Even if I wire for all of the material it won't get here in time. Then you couldn't use it and I would have it all on hand."

"O. K.," Evans turned as if he were going to leave the storeroom, "I'll just tell the master mechanic that it's impossible for me to get locomotives ready for the extra trains because of material shortage."

"But that would place me in an awful hole," the storekeeper almost moaned. "You can't do that."

"The hole I'm in already is big enough for two of us," Evans replied.

"How am I going to explain it?" the storekeeper asked.

"Well, just wire the system storekeeper that on account of an emergency caused by these additional trains this material is required immediately and request that it be loaded in a baggage car and shipped by the first passenger train. That's our only chance."

In the meantime the hostler had shoved two of the dead engines into the house. One of them, the 5094, had been robbed of feed-water pump and lubricator besides several valves. The foreman told Jenkins to take the needed appliances off the 5087, no chance of getting her ready to run anyway.

The two machinists that came in at noon, Henderson and Thomas, had one helper between them. They went to work on the other locomotive, the 5096. Henderson was told to inspect the engine and make out a work report of repairs needed. "And don't report anything that isn't absolutely necessary unless it's a government defect," Evans added.

The three machinists worked with a will until about the middle of the afternoon when Evans came by. Henderson appeared to be stalling and Thomas wasn't in sight.

"How are you getting along?" Evans asked.

"Waiting on machine work," Henderson said.

The foreman went to the machine shop to see how things were going. The reduction in force had just left three machine men. Cox did most of the lathe work. Jenkins was on the wheel lathe and occasionally helped out on one of the small lathes, while Martin tried to keep up with work on the boring mill, shaper and planer. All three of the men were busy. Cox had his eighteen-inch lathe in high and was making brass shavings fly but at that it would take two days for him to finish all the rough brass stacked by the lathe.

"Have you started on the bushings for the 5096?" Evans asked the machine man.

"No," Cox replied, "I've still got a main brass, two middle connections, and three other bushings for running repair jobs."

Jenkins was busy turning a set of tires for an engine to run that night and Martin was boring driving boxes for the same engine.

Not one of the three men called back were good machine men. Then Evans remembered that the one reporting next morning was not a machine man either. Of course all of them had done some machine work but it had been a long time ago and none of them had been exceptionally good.

Evans went to the office. "Have you tried to see if you can locate any more machinists?" he asked the clerk. "You know there isn't a single machine man in the bunch."

"All of the good machine men have got jobs, I guess," Harris said. "The only two that I know of that were cut off went to work at a navy yard somewhere."

"That's a hell of a mess!" Evans groaned. He turned and left the office.

He went back to the machine shop and told Cox to work overtime until he had finished the bushings for the 5096 so that the men working on the engine would have them ready next morning. He then told Henderson and Thomas to start working on the 5094.

Next day two more of the engines were taken out of storage and shoved in the house. There wasn't any stall room for the other one.

Work progressed very nicely until noon, then almost came to a standstill for lack of material. Just before the twelve o'clock whistle blew, Evans went to the store-room to see if there was any message about the material that had been ordered.

"Haven't heard a thing," the storekeeper said, "and if I do it may be a message telling me that I am fired."

"Well, if they'll let me go by the way, I'm eligible for my pension," Evans said. "And if that material doesn't come in on the Limited tonight I'll need it."

Evans went home for lunch more from habit than hunger. Even the strawberry shortcake, his favorite dessert, didn't taste good as usual.

At one o'clock the storekeeper still hadn't heard anything. At one-thirty the dispatcher called and wanted to know how the engines were coming along for the troop trains.

"From the way it looks now," Evans said, "they're coming like airplanes for the Allies—on the way but maybe too late."

He had just hung up the receiver when the storekeeper came in carrying a yellow slip of paper. "Your material will be here on the Limited tonight," the storekeeper said. "You can always depend on the store department."

"Yeah, you can always depend on the store department to leave you in a hole. Say, how about having the car set out by the side of the machine shop where it'll be handy," Evans added.

"Might be a good idea at that. Besides, it'll save having my men unload it," the storekeeper said.

That afternoon an engine was finished on the drop-pit and the other stored engine shoved in and men set to work taking down parts to be repaired or replaced. That done, there was little more to do but wait for the car of material and hope for the best. Evans told the night foreman to be sure and work every engine that came in during the night and have them ready to go next day even if it meant working the entire night force overtime. He also told Cox and Martin to come to work at six o'clock next morning and start making bushings.

Evans came down at six next morning too. He found the entire night force still working. Cox and Martin were there but weren't working. The baggage car with the material in it hadn't been brought to the roundhouse.

Evans called the third trick dispatcher and asked him when the car would be set.

"Don't know," the dispatcher said. "Call the yardmaster."

"We've got a lot of work in the yard," the yardmaster said, "but we should be able to get it by ten o'clock."

Evans swore and called the superintendent at his home. Thirty minutes later the switch engine came up to the roundhouse lead shoving the baggage car.

Everybody in the roundhouse except one inspector and the two laborers that clean the house went to work on the five engines when the eight o'clock whistle blew. The 5096 that had only needed a mainrod bushing was ready to run out of the house before ten o'clock.

"One out and four to go," Evans said as the hostler ran the engine across the turntable.

All of the men were working but busiest of all were Cox and Martin making bushings for the engines. The way those two nutsplitters were turning out bushings was a sight. One cut to get the size and a few licks with a file to smooth them up and the outside was finished. Two cuts on the inside and here's another bushing. Then blam! clash!—the old lathe Martin was running started to fall apart like the old one horse shay.

The machinist found the foreman and told him what had happened.

"How long will it take to repair it?" Evans asked.

"About two days if we had the parts," Martin told him.

When Jim Evans gets too worried to swear he's in a bad way and this was one of the few times he was ever in that condition. He stood for a moment as though ready to walk off and leave the whole thing. Then he shrugged his shoulders and said, "Maybe now I might get that new lathe they've been promising for the past five years."

"I can do fairly well making the large bushings on the boring mill," the machinist said, "but it'll be a little slow."

"That's right," Evans agreed. "If the old boring mill don't blow up too! Go ahead and do the best you can."

The five o'clock whistle wasn't quitting time for most of the men that afternoon but just a signal that overtime was beginning.

At six o'clock the dispatcher called and wanted to know if two of the 5000's were ready to go at eight. "Then I'll want two more at nine and two at ten-thirty," he added.

"Tell him," Evans said, "the two will be ready at eight. I hope we can have two for nine and not to figure too strong on any more."

Evans had been figuring on using the engine that came in on the Limited for one of the troop trains and it came in with a badly cracked siphon and that left him one engine short any way he figured it. (He sat down at the desk in the office and began thinking aloud.) "The engine that comes in on the first extra we can turn for the seventh train and so on, but I've got to have something to pull the first six, which I haven't." The phone interrupted his reverie.

"If it's the dispatcher, tell him I'm not here. Tell him I've joined the Foreign Legion."

The clerk answered the phone. "O. K., yes, I'll tell him," he said and hung up and turned to Evans who was braced for the bad news. "The dispatcher said that there was some delay loading the troops and equipment and the trains would be about six hours later than the lineup. He'll let you know later about the other four engines."

"I've cussed the government for being slow plenty of times," Evans said, "but this is one time I'm thankful for it. I'm going home and go to bed. . . . Good-night."

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Determining Boiler Evaporation, Size of Injector and Safety Valves

Q.—What is the proper method of figuring the amount of water used in a boiler per hour? What is the proper method to be used in determining the size of both the injectors and the overhead muffler applied on modern locomotives? I am interested in purchasing a hand book that is applicable to railroad work in connection with the figuring of locomotive problems such as, speed, boilers, coal and water consumption, etc. Can you advise me where such a book may be purchased?—F. A. J.

A.—The amount of water used in a locomotive boiler per hour is based on the evaporative values of the tubes, flues, arch tubes and firebox. The evaporative value of tubes and flues is taken at 10 lb. per hr. per sq. ft. of outside surface. The evaporative value of the arch tubes and firebox is taken at 55 lb. per hr. per sq. ft. Best available data shows that the evaporative value of tubes

and flues varies with the difference in length, diameter and spacing. F. J. Cole's "Locomotive Ratios" give the evaporative values for locomotive boiler tubes and flues based on the diameter, spacing and length.

Example: Given a boiler having 248 2-in. o. d. tubes, $\frac{3}{4}$ in. spacing, 20 ft. long and 34 $\frac{5}{8}$ -in. o. d. flues, 1 in. spacing, 20 ft. long and 232.5 sq. ft of firebox and arch-tube heating surface

From Cole's Ratio we find that a 2 in. tube, 20 ft. long, has a heating surface of 10.472 sq. ft. and an evaporative value for $\frac{3}{4}$ in. spacing of 8.32 lb. per sq. ft. per hr.

The total evaporative value of the tubes would then be

$$10.472 \times 8.32 \times 248 = 21,607 \text{ lb. per hr.}$$

From Cole's Ratios we find that a $\frac{5}{8}$ -in. flue, 20 ft. long, has a heating surface of 28.143 sq. ft. and an evaporative value for 1 in. spacing of 10.22 lb. per sq. ft. per hr.

The total evaporative value of the flues would then be

$$28.143 \times 10.22 \times 34 = 9,780 \text{ lb. per hr.}$$

The evaporative value for arch-tube and firebox surface is 55 lb. per sq. ft.

The total evaporative value of the arch tubes and firebox would be

$$232.5 \times 55 = 12,788 \text{ lb. per hr.}$$

The total water evaporated per hr. by the boiler would be

$$21,607 + 9,780 + 12,788 = 44,175 \text{ lb. per hr.}$$

Injector sizes are based on steam and water consumption per cylinder horsepower, for basis of calculation the steam and water consumption are taken as follows:

Cylinders	Maximum steam consumption per cylinder hp.-hr.		Gallons
	Steam	Pounds	
Simple	Saturated	27.0	3.24
	Superheated	20.8	2.50
Compound	Saturated	23.5	2.82
	Superheated	19.7	2.36

The above is based on the boiler and cylinder horsepower being equal. When the boiler horsepower is less than the cylinder horsepower, make proportional decrease or increase in capacity of injectors.

For road service the per cent of maximum steam consumption supplied by one injector is taken as 75 per cent for coal burners and 87 per cent for oil burners.

The above is based on 200 lb. pressure. For each 10 lb. pressure under 190 lb. deduct 2 per cent of the capacity as calculated.

Cylinder horsepower is obtained as follows:

$$\text{Hp.} = .02120 \times P \times A \text{ for saturated steam}$$

$$\text{Hp.} = .02290 \times P \times A \text{ for superheated steam where}$$

Hp. = cylinder horsepower

P = boiler pressure, lb. per sq. in.

A = area of one cylinder diameter.

The maximum horsepower is assumed to be reached at piston speeds of 700 ft. per minute with saturated steam and 1,000 ft. per minute with superheated steam.

Example:

Given a coal-burning road locomotive with 25 in. cylinders, superheated steam, 200 lb. pressure. Boiler and cylinder horsepower being equal. The cylinder horsepower would be

$$\text{Hp.} = .02290 \times 200 \times 490.87$$

$$\text{Hp.} = 2,081$$

The water consumption would be

$$2,081 \times 2.50 = 5,200 \text{ gals. per hr.}$$

(Continued on next left-hand page)



1,459,000 CHILLED WHEELS PURCHASED in 1939... EXCEEDS 1938 BY 179,000 WHEELS

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Requiring a capacity of 75 per cent of maximum consumption, each injector must therefore supply

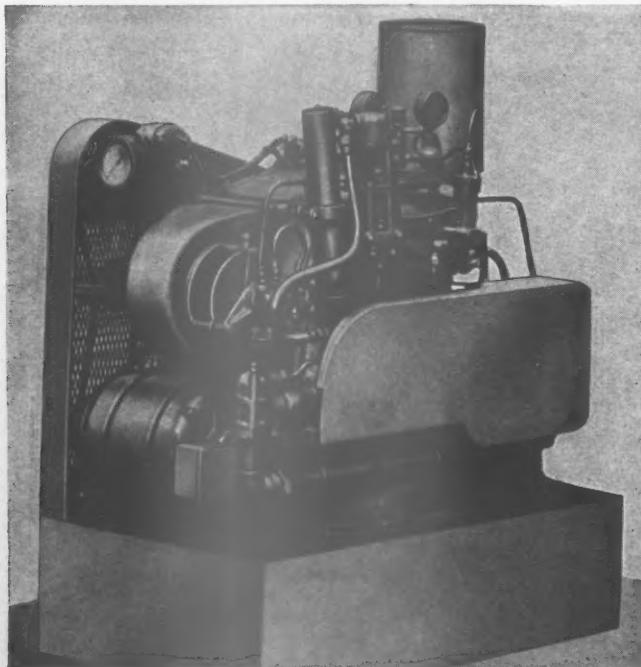
$$5,200 \times .75 = 3,900 \text{ gals. per hr.}$$

Safety Valves

The required discharge capacity of a safety valve or valves for a boiler may be based either on the heat units in the fuel consumed or on the amount of steam generated. Rules and examples are given in the A. S. M. E. Code Book. Books on locomotive boiler problems are as follows: (1) For rules and formulas covering boiler calculations; the A. S. M. E. Boiler Code, Section III, published by the American Society of Mechanical Engineers, 29 West 39th street, New York City; (2) for basic design and theory of constructional details; Design of Steam Boilers and Pressure Vessels, by Haven and Sweet, published by John Wiley & Sons, Inc., New York City; (3) a practical locomotive boiler book; A Study of the Locomotive Boiler, by Lawford H. Fry, published by the Simmons-Boardman Publishing Corp., New York City; and (4) for the development of the plates of a locomotive boiler; Laying Out for Boiler Makers, published by the Simmons-Boardman Publishing Corp., New York City.

Locomotive and Car Cleaner

The No. 4941 Vapor Thermo-Pressure cleaning machine has been developed by the Vapor Car Heating Company, Chicago, especially for cleaning railroad cars and locomotives and is designed to deliver 8 gal. of water per min. at temperatures up to 165 deg. F., and at pressures up to 175 lb. It can be operated by electric or gasoline engine power and is available in either the stationary or the portable type. Some of these units have been in operation during the past year, particularly for cleaning locomotives. Diesel oil, or its equivalent, is recommended



Vapor No. 4941 Thermo-Pressure machine for cleaning locomotive and car equipment

for fuel. The fuel consumption is said to be only four gal. per hour and it is used only during the actual time the cleaner is in operation. The unit will build up to full pressure and temperature within two minutes from the time it is started.

In addition to the small water tank, a separate "solution" tank is installed for use as desired. When cleaning locomotives, a special gas oil or "U. G. I. Cleaning Oil" is automatically added to the water, which leaves a thin film to protect metal parts against rusting.

Special pump and by-pass features are incorporated to meter the oil or other cleaning solution into the water as desired. All necessary control and safety features are installed. When the hand valve on the cleaning nozzle is closed, the fire will shut down, and automatically come on again when the nozzle valve is opened. In case of failure of water supply, the burner will shut down. The unit is constructed on the Clarkson staggered-coil principle.

One of the important economies which must be credited to the Vapor Thermo-Pressure cleaner is avoidance of the necessity of carrying locomotive steam pressure on main boiler plants during summer months for washing locomotives, car trucks, and freight or passenger cars.

Paducah Shop Jigs, Fixtures and Devices

(Continued from page 327)

brass rigidly in the fixture during the machining operation.

Crown brasses, placed and held in the arrangement, can be machined accurately and quickly and in addition there is a saving of time in the setting up operation.

Moving A Pair of Driving Wheels

Necessarily numerous locomotive parts are moved from place to place at any locomotive repair shop and these moving operations become greater in proportion to the size of the shop and volume of the work.

At Paducah shop, the method of moving mounted driving wheels is shown in one of the illustrations. A five-ton lift truck is used with the blocking carefully placed clear of the journals. Before adopting this method of moving them the rolling and handling of driving wheels was slow and expensive.

Opening A Shop Door

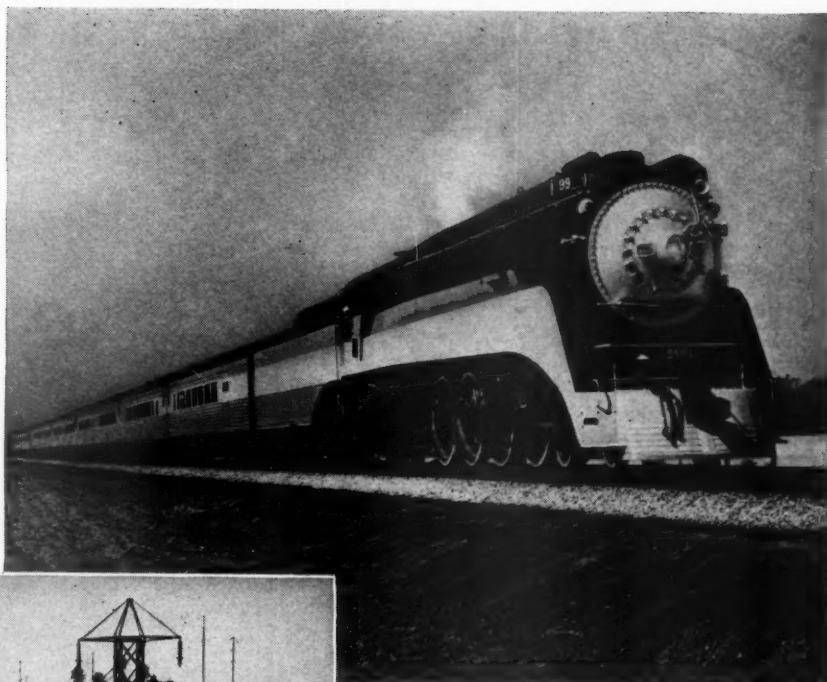
An air-operated shop door opener and closer is used for passing lift trucks, crane trucks and other pieces of like equipment through the shop door. Operating equipment inside the shop consists of a 3-in. cylinder of a length to accommodate the door opening. A $\frac{3}{4}$ -in. piston rod is used with leather-packed piston and a cushion in each end of the cylinder with springs to check the travel of the door as it opens or closes.

Shop air pressure is used, but through a reducing valve set at just sufficient pressure to operate the door. A three-way valve is installed and operated by a tiller rod with rope control which extends out 12 ft. on either side of the door in easy reach of truck operators who can open the door, pass through it and close it from the inside without getting off the truck.

Another advantage to this arrangement is that when the trucks pass in or out of the door, it remains open a minimum of time and saves admitting a large amount of cold air into the building. The door opener, of course, is used only during the winter months.

FAMOUS
TO
PASSENGERS
AS

Daylights



FAMOUS
TO
SHIPPIERS
AS
"Overnights"

To meet the requirements of shippers for "speed" some of the more progressive railroads are now using the same locomotives for both heavy duty passenger and high speed freight service.

This trend is becoming increasingly popular with shippers as a time saver and with the railroads as a revenue producer. Photo courtesy Southern Pacific Company.

LIMA LOCOMOTIVE WORKS



INCORPORATED, LIMA, OHIO

High Spots in Railway Affairs . . .

Railroads and National Defense

Transportation is naturally one of the most vital links in the national defense program, as well as in actual warfare. The railroads must be depended upon to function as its backbone, since they will handle the long and bulky, or mass production movements. Their activities, however, must be closely co-ordinated with other types of transportation in order to secure the most efficient and effective service in the movement of men and materials. Lessons learned from experiences in the first World War and in the reconstruction period resulted in the preparation of carefully made plans to meet future contingencies. The railroads, therefore, now find themselves in far better position to face the demands that may be made upon them than when a similar situation confronted them a quarter of a century ago.

Ralph Budd's Progress Report

Ralph Budd, president of the Burlington, and one of the six members of the National Defense Advisory Commission, heads up its Division of Transportation. In reporting to President Roosevelt on July 16, he pointed out that his division was working closely with the A. A. R. and the American Short Line Railroad Association. He emphasized "the need for full performance by all lines of the repair work necessary to reduce cars in bad order to not more than six per cent," as was agreed upon by these associations. Special rolling stock will be required for handling troops and their equipment. President Roosevelt has indicated that this should be paid for by the government, since it will not be of use for civilian transportation movements. Special flat cars will be needed, for instance, for the loading of tanks within the clearance limits. These matters are receiving special attention by Mr. Budd and his staff.

Mr. Budd's Advisors

One of the first acts of Mr. Budd was to appoint to his staff the following four consultants: A. T. Wood, president, Lake Carriers Association, Cleveland, Ohio; Ted V. Rodgers, president, American Trucking Associations, Inc., Washington, D. C.; F. C. Horner, New York, assistant to the chairman, General Motors Corporation; and Arthur M. Hill, president, National Association of Motor Bus Operators.

About the middle of July the following additional four men were appointed advisors: J. M. Hood, president of the American Short Line Railroad Association; Thomas P. Henry, president of the American Automobile Association; Fayette B. Dow, Washington representative of the American Petroleum Institute; and A. W. Dunn, of the Union Barge Line Corporation, Pittsburgh, Pa.

Rail-Labor National Defense Committees

Transportation associations have been prompt to indicate a willingness to aid in the national defense program. This has been true, also, of the labor organizations. Committees to co-operate in the disposition of problems of mutual interest which may arise from this program have been appointed by the A. A. R. and the Railway Labor Executives' Association. It is understood that the functions of these special committees will not supersede or replace in any way the regular machinery for dealing with hours, wages and working conditions; their work will be confined to matters arising under the defense program.

C. S. D. Creates Military Transportation Section

A Military Transportation Section has been created by the Car Service Division, A. A. R., with Arthur H. Gass as manager, effective August 1, to maintain close liaison between military forces and the railroads.

Freight Car Requirements

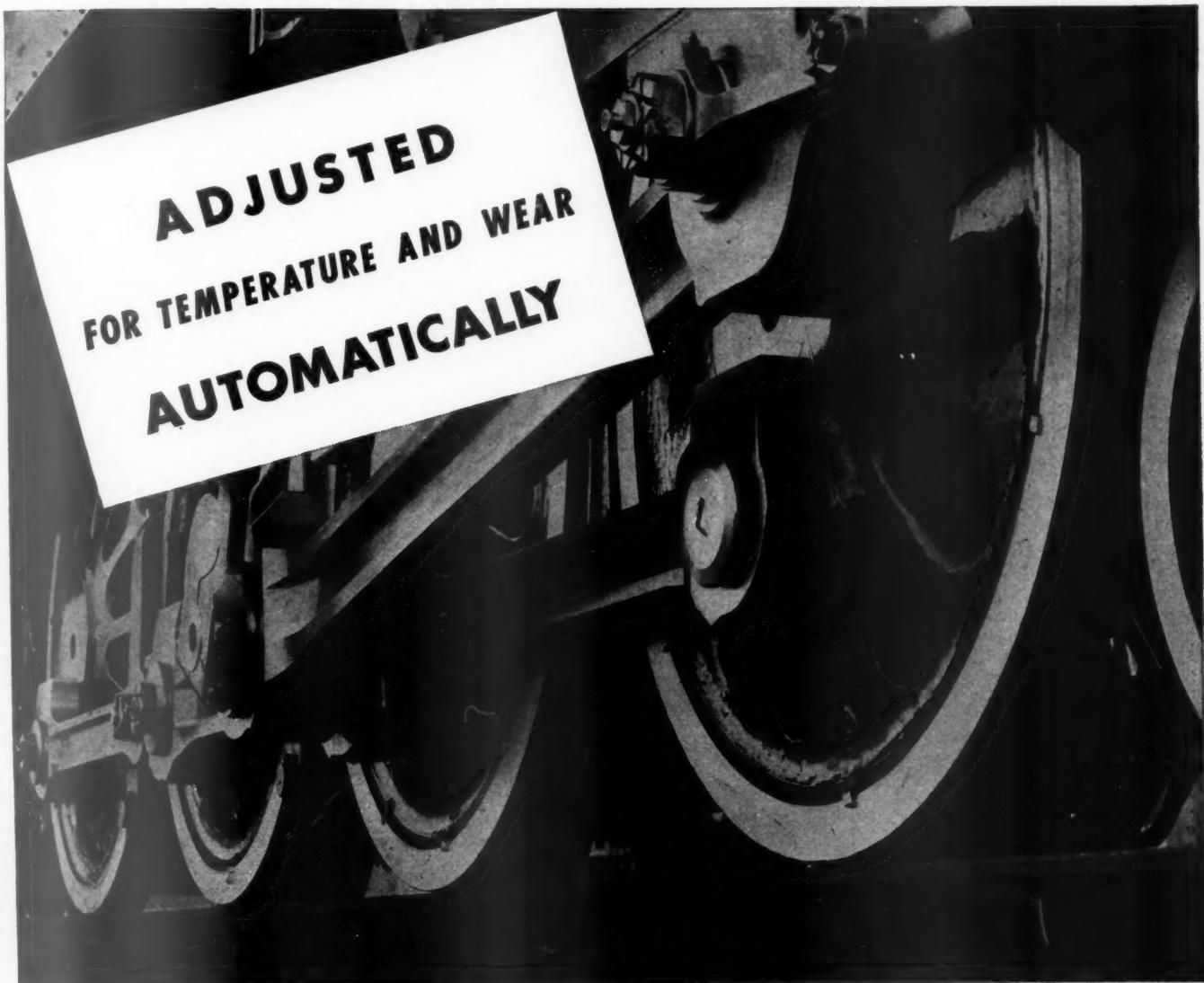
The railroads face the necessity of acquiring a half million new freight cars before the end of 1942. This is the tentative conclusion of R. N. Janeway in a report prepared for the National Resources Planning Board. It has not yet been presented to the board, but has been distributed in a limited way for confidential review and criticism. The estimate is based on a study of the correlation between carloadings and the Federal Reserve Board index of industrial production, and assuming maximum potential production with full employment. The study indicates that by the end of 1942, about 360,000 more cars will be required than are now available. Meanwhile, however, 140,000 cars will become due for retirement, so that in all 500,000 new cars will be retired.

Mr. Gormley's Estimates

M. J. Gormley, executive assistant of the A. A. R., certainly knows railroading. Moreover, no railroad officer has had so close a contact with the War Department and its needs. In speaking before the Northwest Shippers' Advisory Board on July 25, Mr. Gormley said, "One of our difficulties now is the hysteria on the part of some people as to the magnitude of the transportation load in connection with the preparedness program." He suggested that the public should not be influenced by "the conclusions of the astronomical statisticians" and also said that "protection from well meaning, but unknowing friends is one of the greatest needs of the railroads." Mr. Gormley based his statements upon the estimate that "the increased annual steel output, maintenance of three million troops and material for camp construction would involve an average rail movement of about 25,396 carloads per week, or about four per cent of the average weekly carloadings in 1939." Double this to be safe and it "offers no very great problem to the railroads." He also pointed out that the freight car supply will be much larger this year than a year ago.

R. B. A. Goes On Record

The Railway Business Association has published a study, entitled Transportation and National Defense. It shows that the burden of such transportation will fall almost entirely upon the railroads and concludes: "But should national defense require the mobilization of forces in large numbers (to implement the preparedness program in actual defense of the nation) there is ground for apprehension that the total traffic thus resulting would be greater than the capacity of the supply of locomotives and cars contemplated by the Association of American Railroads—or that could be made available from the small unserviceable inventories that remain." It suggests that the federal agencies responsible for formulating and executing the national defense program should take this into consideration and make provision for the contingency. "Such provision of rail equipment is as much a part of the cost of war and preparation for war," says the report, "as emergency building of shipping in 1918 or the expansion of airplane factories in 1940, or the sinking of government moneys in highways and waterways for the alleged purpose of promoting the national defense."



Variations in the driving box temperature, which in some instances are as much as 250° in short periods of time, no longer affect the fit of these driving box wedges. This ever-present problem has been effectively solved by the application of Franklin Automatic Compensators and Snubbers. Now, this locomotive leaves the roundhouse with a snug fit; as the driving box becomes heated the wedge is automatically pushed down, keeping a constant, pre-determined adjustment at all times. As the driving box cools, the wedge automatically compensates for the contraction. In addition, abnormal shocks are taken care of by a heavy outer spring that acts as a cushion. » » » For constant, accurate adjustment . . . easier riding, prevention of pounds . . . at any temperature . . . apply Franklin Automatic Compensators and Snubbers.



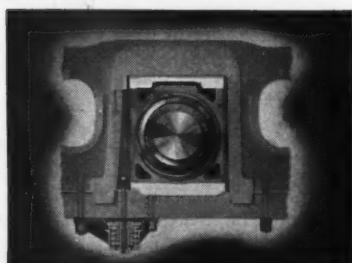
FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK

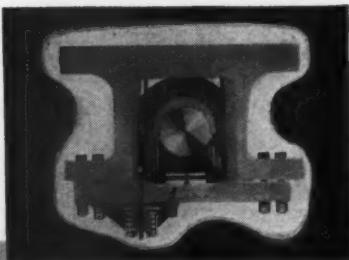
CHICAGO

MONTREAL

August, 1940



ABOVE: Franklin Automatic Compensator and Snubber for Roller Bearing Driving Box application. BELOW: Franklin Automatic Compensator and Snubber for Friction Bearing Driving Box application.



NEWS

"400's" Locomotives Complete 300,000 Continuous Service Miles

Two 4,000-hp. Diesel-electric locomotives which the Chicago & North Western uses to haul its "400" and its North Western Limited between Chicago and the Twin Cities, completed 300,000 miles each in continuous service on July 13. The locomotives were delivered to the railroad in May and June, 1939, and after test runs, were used on the North Western Limited in July, August and September. With the placing in service of the new "400" on September 24, 1939, they were also assigned to the "400" on a schedule which provides for morning arrival at each terminal with the North Western Limited and afternoon departure with the "400." As a result, each of these locomotives has traveled 861 miles per day since September 24, 1939, and has been on the road 16 hr. 35 min. in each 24 hours.

Equipment Purchasing and Modernization Programs

Chesapeake & Ohio.—On July 15, the Chesapeake & Ohio awarded an issue of \$2,500,000 of one- to ten-year 1½ per cent equipment trust certificates to Blyth & Company, Inc., at a price of 101.777, which represents an interest cost to the company of about 1.41 per cent. The certificates, dated August 1, 1940, will be payable in 10 equal annual installments. The funds will be used to finance in part the purchase of new equipment, including 1,000 box cars and 100 cabooses. Blyth & Co. have offered the issue of \$2,500,000 certificates at prices to yield from 0.25 per cent for 1941 maturities to 1.75 for certificates maturing in 1950.

The C. & O. is also contemplating the repair of its coach shop building at Richmond, Va., replacing wood floors with concrete, providing additional pit tracks and overhead cranes, and replacing swinging doors with overhead doors; and erecting a new paint spraying building with canopy exhaust system, lean-to and toolroom at Huntington, W. Va., all of the above work to cost approximately \$99,000. Plans are being prepared to ask for bids on the overhead doors at Richmond and all of the work at Huntington, the balance of this work to be done by company forces.

Illinois Central.—The Illinois Central awarded a contract to the Knickerbocker Roofing & Paving Co., Chicago, for repairs and recoating of the roofing on all shop buildings at the Paducah shops, Paducah, Ky. Another contract has been awarded to the H. J. Yeldham Company, Chicago, for making repairs to monitor sash, gutters, downspouts, flashing and other sheet metal work on the roofs of these buildings. The total cost of this work will be about \$50,000.

Norfolk Southern.—Division 4 of the Interstate Commerce Commission has approved a plan whereby the Norfolk Southern would issue and sell to the Reconstruction Finance Corporation \$136,000 of 2½ per cent equipment trust certificates maturing in semi-annual installments of \$7,000 from February 1, 1941, to August 1, 1948, inclusive, and of \$6,000 from February 1, 1949, to August 1, 1950, inclusive.

Pennsylvania.—The Pennsylvania has asked the Interstate Commerce Commission for authority to assume liability for \$7,995,000 of 2½ per cent equipment trust certificates, maturing in annual installments of \$533,000 on July 1, of each year from July 1, 1941, to and including July 1, 1955. The proceeds will represent 80 per cent of the total purchase price of equipment costing \$9,993,750, and consisting of 2,545 freight cars, 25 steam locomotive tenders, two steam passenger locomotives and tenders, and eight lightweight passenger cars. The petition states that the Pennsylvania will construct the freight cars and tenders in its own shops.

New Freight Cars Put in Service in First Half Year Total 36,852

CLASS I railroads put 36,852 new freight cars in service in the first six months of 1940, according to the Association of American Railroads. This was the largest number installed in any corresponding period since 1930 when 49,208 new cars were put in service. In the first half of 1939, there were 8,628 new freight cars installed.

Of the total number of new freight cars placed in operation in the six months' period this year, coal cars numbered 19,076; box, 16,007; refrigerator, 595; flat, 569; stock, 88, and miscellaneous, 517.

At the same time, the railroads installed in service 180 new locomotives, of which 45 were steam and 135 were electric and Diesel-electric. Installed in the first six months in 1939 were 126 new locomotives, of which 16 were steam and 110 were electric and Diesel-electric.

Class I railroads on July 1 had 16,933 new freight cars on order, compared with 10,062 on the same day last year. On June 1, there were 15,039 new freight cars on order. Among the new cars on order on July 1 were 9,286 box; 7,005 coal; 245 flat; 50 refrigerator, and 347 miscellaneous. The railroads on July 1 also had 124 new locomotives on order, of which 97 were steam and 27 were electric and Diesel-electric. On the same day one year ago, there were 108 on order, of which 60 were steam and 48 were electric and Diesel-electric.

Freight cars and locomotives leased or otherwise acquired are not included in the above figures.

Average Age of Railroad Workers 43 in 1938

"JUST under 43" was the average age of all workers covered by the Railroad Retirement Act in 1938, according to age data summarized in an article appearing in the latest issue of the Railroad Retirement Board's Monthly Review. The data on ages by occupations show that engineers and conductors are the oldest group with an average age of 55.1 years, and extra gang men the youngest group with an average age of 32.7 years.

Occupations of annuitants are shown in another study. The largest proportion of annuitants of Class I roads comes from the skilled maintenance of equipment group which makes up 16.8 per cent of the total and the senior train and engine service groups which account for 16.6 per cent.

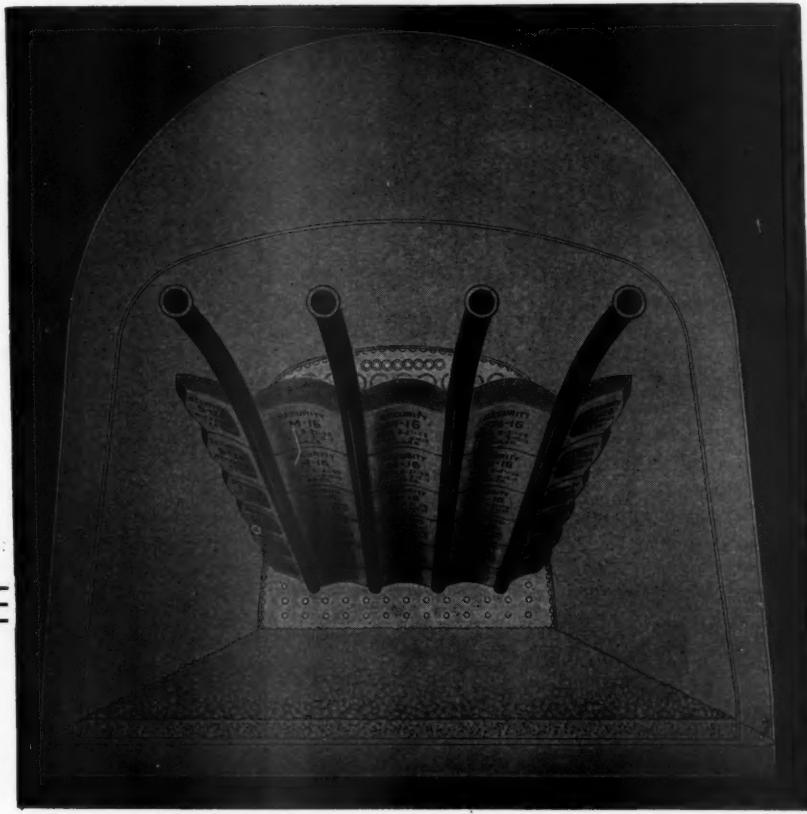
Department of Justice Sues Pullman

THE Department of Justice on July 12 filed in the Federal District Court at Philadelphia, Pa., a complaint under the federal anti-trust laws against the Pullman Company and its affiliates and officers. "Briefly stated," said Assistant Attorney General Thurman Arnold in announcing the suit, "the substance of the complaint is that the Pullman organization has prevented the railroads from using modern, lightweight, streamlined cars manufactured by competing companies in order to maintain in service its own obsolete equipment. It is charged in effect that the dominant position of the Pullman organization has given it power to force on the railroads restrictive contracts which compel them to use Pullman-built-and-operated sleeping-car equipment exclusively, or it cannot be used at all. It is alleged that the railroads and the traveling public have been denied the widespread use of modern equipment by the monopolistic practices of the Pullman organization."

Later on the Arnold statement explains that the action is a civil suit. Such procedure was decided upon instead of a criminal action because the contracts between Pullman and the railroads "have been publicly recorded for many years with the Interstate Commerce Commission."

"A civil proceeding is also necessary," continues the complaint, "because of the nature of the relief required. The Department believes that certain provisions of the operating contracts between The Pullman Company and the railroads should be cancelled and that the corporation which manufactures rolling stock should be divorced from the corporation which operates sleeping-car service. This relief can only be gained through civil proceedings."

Dissolution of the holding company-Pullman, Inc., as the means of divorce (Continued on next left-hand page)

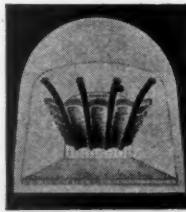


ANYTHING less than a complete arch IS FALSE ECONOMY

To let the desire for reduced inventory result in a locomotive leaving any round-house without a full set of Arch Brick is poor economy. » » » Even a single missing Arch Brick will soon waste many times its cost in fuel and in locomotive efficiency. » » » To spend the fuel dollar efficiently, every locomotive Arch must be maintained 100%. » » » Be sure your stocks on hand are ample to provide fully for all locomotive requirements, so that locomotive efficiency may be maintained.

There's More to SECURITY ARCHES Than Just Brick

**HARBISON-WALKER
REFRACTORIES CO.
*Refractory Specialists***



**AMERICAN ARCH CO.
INCORPORATED**
60 EAST 42nd STREET, NEW YORK, N. Y.
***Locomotive Combustion
Specialists***

of the two corporations is contemplated in the action.

The complaint names as defendants four corporations and 31 individuals. The corporate defendants are: The Pullman Company; Pullman-Standard Car Manufacturing Company; Pullman Incorporated; and Pullman Car & Manufacturing Corporation of Alabama. The individual defendants are officers or directors of these companies.

I. C. C. Authorizes Experimental Cars

THE American Car & Foundry Company has been authorized by the Interstate Commerce Commission in a report by Commissioner Johnson to construct 10 fusion-welded tank cars for experimental service in the transportation of petroleum products.

The General American Transportation Corporation has been authorized in the same manner to construct one fusion-welded tank car for experimental service in the transportation of caustic soda solution.

I. C. C. Modifies Locomotive Inspection Rule 116(b)

RULE 116(b) of the Rules and Instructions for the Inspection and Testing of Steam Locomotives and Tenders and their Appurtenances has been amended by the Interstate Commerce Commission to read as follows:

(b) The front cab doors or windows of road locomotives used in regions where snowstorms are generally encountered shall be provided with what is known as a "clear vision" window, or an appliance that will clean the outside of such doors or windows over sufficient area to provide a clear view of track and signals ahead. If a "clear vision" window is used it shall be not less than 5 inches high located as nearly as possible in line of the engineman's vision and so constructed and fitted that it may be easily opened, closed and fastened in desired position.

The amendment was made in an order by Commissioner Patterson which set forth, as noted in the May issue of the *Railway Mechanical Engineer*, that the railroads had been cited to show cause by July 1 why the amendment should not be ordered. One of the "whereas" in Commissioner Patterson's order stated that "no cause has been shown by any said common carrier or party, within the time specified by the order." Language in the foregoing, not found in the present rule, includes the reference to "an appliance that will clean the outside of such doors or windows . . ."

Eastern Car Foreman's Outing

NEW Haven Day, the annual outing of the Eastern Car Foreman's Association, was held at the Race Brook Country Club, New Haven, Conn., July 11 with an attendance of approximately 200 members and guests. The prize winners in the principal events were as follows: In the golf tournament Harry Nunn, Boston & Albany, took the high prize for low gross. In Class A T. M. Ferguson, American Arch Co., the low gross for the Class A golfers and Charles Stone, Railway Sales Co., was the low net winner in the same class. In Class B J. W. Cook, General

Steel Castings Corporation, won low gross prize and D. C. Wilson, Thos. A. Edison, Inc., took the prize for low net score. The Class C winners were George Clarke and H. P. Hass, New Haven Road, and H. G. Davis, Railway Sales Co., took the kickers' prize. H. W. Quinlan, New Haven Road, and J. S. Doyle, Johns-Manville Company, were the putting winners. There were 26 other prizes distributed by drawing at the dinner.

George M. Verity Honored

WHILE 20,000 of his employees and townsmen at Middletown, Ohio, looked on, George M. Verity, chairman of the American Rolling Mill Company, on July 4 was given the title of America's outstanding "Humanizer of Business" by B. C. Forbes, business columnist and publisher of *Forbes Magazine*. A twilight parade of 3,500 marchers preceded the ceremony — composed of Legionnaires, national guardsmen, armored cavalry units, naturalized citizens, industrial workers, and other organizations.

"Not one hour of work has ever been lost during The American Rolling Mill Company's 40 years' existence through labor strife," said Mr. Forbes in bestowing

the award. "So fully have employees been taken into consultation and confidence all through the years, that when outside influences from time to time sought to intrude, the men overwhelmingly turned thumbs-down."

"From his earliest small-scale beginnings to and through years of spectacular growth and success, Mr. Verity has questioned no applicant for work as to his affiliations, religious, political or with organized groups. His humane policies enabled him to get along harmoniously with all honest-intentioned men. Long, long before the government took up 'social-security,' this employer's work folks enjoyed it in generous measure. They enjoyed—and still enjoy—far greater benefits, privileges, consideration, than anything written into law even today."

The Committee of Award included: Dr. Carl W. Ackerman, Evans Clark, Dr. Kenneth Dameron, Benjamin A. Javits, General Hugh S. Johnson, Dr. Virgil Jordan, H. J. Kenner, Dr. Julius Klein, J. T. Madden, Dr. Oscar S. Pulman, Ogden Reid, Dr. Christian F. Reisner, Dr. Alexander G. Ruthven, Philip C. Staples, Dr. Rufus B. von Kleinsmid, E. R. Weidlein, Whitling Williams, and Dr. Stephen S. Wise.

Orders and Inquiries for New Equipment Placed Since the Closing of the July Issue

LOCOMOTIVE ORDERS			
Road	No. of Locos.	Type of Locos.	Builder
Alaska	1	4-6-2	Baldwin Loco. Wks.
Atchison, Topeka & Santa Fe	10	4-8-4	Baldwin Loco. Wks.
Baltimore & Ohio	9	1,000-hp. Diesel-elec.	Electro-Motive Corp.
	16	600-hp. Diesel-elec.	Electro-Motive Corp.
C. R. I. & P.	1 ¹	2,000-hp. Diesel-elec.	Electro-Motive Corp.
Illinois Central	1	2,000-hp. Diesel-elec.	Electro-Motive Corp.
Reading	3 ²	660-hp. Diesel-elec.	Electro-Motive Corp.
	2	1,000-hp. Diesel-elec.	Baldwin Loco. Wks.
	4	600-hp. Diesel-elec.	Electro-Motive Corp.
	1	1,000-hp. Diesel-elec.	American Loco. Co.
	3	600-hp. Diesel-elec.	Baldwin Loco. Wks.
Sao Paulo-Parana Railroad of Brazil	1	2-8-2	
LOCOMOTIVE INQUIRIES			
Reading	10	Diesel-elec.	
Union Pacific	16	4-6-4	
FREIGHT-CAR ORDERS			
Road	No. of Cars	Type of Car	Builder
American Refrigerator Transit Co.	100	Refrigerator	Company shops
Illinois Central	1,000	40-ton box	Pullman-Std. Car Mfg. Co.
	1,000	50-ton box	Gen. Amer. Transp. Corp.
	500	40-ton box	American Car & Fdry. Co.
	500	Automobile	Mt. Vernon Car Mfg. Co.
Louisville & Nashville	25	70-ton hopper	Pullman-Std. Car Mfg. Co.
Newburgh & South Shore	60	75-ton ore	Pullman-Std. Car Mfg. Co.
Norfolk & Western	50	50-ton box	Greenville Steel Car Co.
	500	Hopper	Virginia Bridge Co.
	500	Hopper	Bethlehem Steel Co.
Virginian	500	50-ton hopper	Company shops
FREIGHT-CAR INQUIRIES			
Atlantic Coast Line	600	50-ton box	
	100	50-ton automobile	
	100	70-ton phosphate	
	50	40-ton stock	
	15	70-ton hopper	
	300	55-ton hopper	
	300	50-ton ballast	
	200	50-70-ton gondola	
Union Pacific	1,000	50-ton ballast	
PASSENGER-CAR ORDERS			
Road	No. of Cars	Type of Car	Builder
Chicago, Rock Island & Pacific	2 ¹	Baggage-express	Pullman-Std. Car Mfg. Co.
	1	Chair	
	1	Pullman	
	1	Dining-observation-lounge	
Illinois Central	1	Observation-lounge	Pullman-Std. Car Mfg. Co.
	1	Diner	
	4	Coaches	
	1	Combination coach	

¹ This equipment is for use in the Rock Island's new St. Louis, Mo.-Twin Cities service next fall.

² The aggregate cost of the 13 units, which are to be used in the Philadelphia Terminal area, is estimated at \$855,000.

Multi-Vent Research Laboratory

THE Pyle-National Company has completed a Multi-Vent research laboratory within a railroad coach at the company's plant in Chicago. This coach laboratory was designed for the testing of various types of Multi-Vent panels, lighting fix-

tures, etc., which will be changed as further progress is made in the study of air distribution.

The laboratory equipment at present consists of Pitot tubes, micromanometers to measure air pressure, laboratory thermometers, velocimeters and Kata-Thermometers for the measurement of extremely

low air velocities, variable speed blowers and heat controls.

A complete analysis of heating or cooling problems for any type of passenger car may be made, as well as a visual study of the resultant air flow and distribution by means of smoke injected into the air stream.

Supply Trade Notes

B. S. WOODMAN has been appointed special representative of the Roller-Smith Company, with headquarters at Bethlehem, Pa.

GEORGE D. CASGRAIN, vice-president of the Griffin Wheel Company, has resigned to become vice-president of the Marquette Railway Supply Company, Chicago.

J. EUGENE JACKSON has been appointed metallurgical engineer of the Copper Iron and Steel Development Association, with headquarters in Cleveland, Ohio.

FRANK PARKER, president of Iron & Steel Products, Inc., Chicago, has been appointed to the Railroad Scrap committee of the Institute of Scrap Iron & Steel. Mr. Parker is known for his collaboration with the Association of American Railroads and the metal industries in connection with scrap standardization.

REPUBLIC STEEL CORP.—Mowry E. Goetz has been appointed district manager at

Chicago for the Republic Steel Corporation, Cleveland, Ohio, succeeding J. L. Hyland, who has been appointed district manager at Cleveland, and F. R. Ward has been appointed assistant district manager at Chicago.

GENERAL STEEL CASTINGS CORP.—James C. Travilla, Jr., has been appointed chief mechanical engineer, General Steel Castings Corporation, with headquarters at Eddystone, Pa., and E. S. Beckette and W. C. Krautheim have been appointed assistant mechanical engineers of the corporation, at Granite City, Ill.

WATSON WILLIAMS has been appointed district superintendent, mechanical department, Southeastern district, of the Oxweld Railroad Service Company, with headquarters at Macon, Ga., to succeed C. S. Wright, deceased. Mr. Williams was born in Milltown, Ga., and began his railroad career with the Central of Georgia at Columbus, Ga., as boiler maker. He has been with Oxweld since August, 1917,

and has served as mechanical instructor assigned to many large railroads in various parts of the country.

AIR REDUCTION COMPANY.—Howard R. Salisbury, assistant manager of the Air Reduction Company at Philadelphia, Pa., has been appointed manager, succeeding William W. Barnes, who has retired after 30 years' active service with the industry, and H. B. Seydel, assistant sales manager of the New York district, has been appointed assistant manager at Philadelphia. Mr. Salisbury has been connected with Airco for 15 years. He was manager at Bettendorf, Iowa, for two years and has been assistant manager at Philadelphia for the past six years.

Mr. Barnes first became associated with the oxyacetylene industry in 1910 when he joined the Davis-Bournonville Company as Philadelphia sales manager. In 1922, when Davis-Bournonville merged with Air Reduction, Mr. Barnes became Air Reduction manager at Philadelphia, a position he held until his retirement.

Personal Mention

General

JAMES E. HALL has been appointed traveling engineer of the Union Railroad Company, with headquarters at Bessemer, Pa.

E. J. McSWEENEY, superintendent of motive power of the Western lines of the Baltimore & Ohio, with headquarters at Cincinnati, Ohio, has been transferred to the Eastern lines, with headquarters at Baltimore, Md.

C. P. BROOKS, supervisor of apprentices of the Erie, has been appointed mechanical engineer, with headquarters as before at Cleveland, Ohio, succeeding F. S. Brown, who is retiring after 48 years of continuous service.

Master Mechanics and Road Foremen

L. JONES, general foreman at Centralia, Ill., of the Illinois Central, has been promoted to master mechanic at Champaign, Ill., succeeding A. G. Kann.

NORMAN BELL, general master mechanic of the Iowa and Springfield divisions of the Illinois Central, retired on July 16, after more than 36 years' service.

A. G. KANN, master mechanic of the Illinois division of the Illinois Central, with headquarters at Champaign, Ill., has been promoted to general master mechanic of the Iowa and Springfield divisions, with headquarters at Waterloo, Iowa.

F. O. WRIGHT, general foreman of the Chesapeake & Ohio, has been appointed master mechanic, Hocking division, with headquarters at Columbus, Ohio, succeeding J. E. Davis, retired.

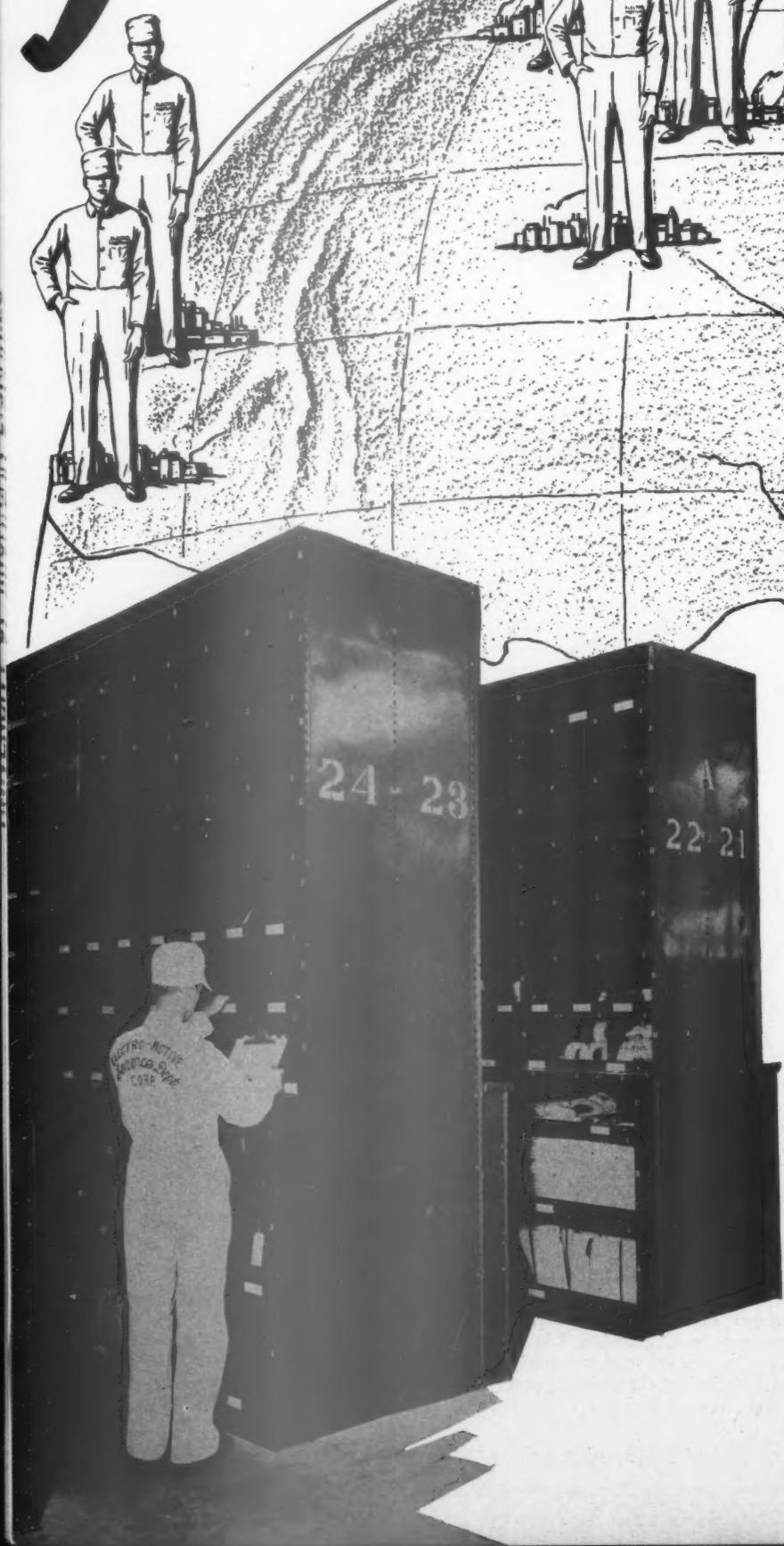
R. C. GOEBEL, assistant to the superintendent of motive power of the Minneapolis & St. Louis, has been appointed general master mechanic, a newly created position, with headquarters as before at Minneapolis, Minn.

Car Department

L. R. SCHUSTER, chief car draftsman of the Southern Pacific at San Francisco, Cal., has been promoted to engineer of car construction with the same headquarters.

(Turn to second left-hand page)

Your Storehouse



Seven Stations to Serve You—

WITH telegraphic speed EMC Service is made available to railroads if and when it is needed... Day and night service on parts from the seven strategically located stations at LaGrange, Illinois—St. Louis, Missouri—Minneapolis, Minnesota—Newark, New Jersey—Jacksonville, Florida—Emeryville and Los Angeles, California—prevents long delays and expensive losses of locomotive hours... Every station is fully staffed and carries a definite and wide assortment of parts so that EMC equipment can be promptly and economically serviced. These EMC facilities make it possible for you to carry a minimum stock thus reducing your investment in spare parts as well as guarding against obsolescence.

OUR INVESTMENT

EMC Nationwide Day and
Night Service an Important
Factor in High Availability
For All EMC POWER . . .

IN the building of EMC Diesel locomotives, superior engineering technique, highest grade materials, the latest precision equipment and the most advanced manufacturing methods have been combined to minimize service needs. Back of every EMC Diesel motive power unit stands General Motors' undivided responsibility which guarantees every part of the equipment.

But that is not all—EMC has set up a nationwide service which is without question unmatched in the motive power industry. EMC maintains a complete stock of parts for all EMC Diesel power regardless of age, including such important auxiliaries as main generators, traction motors, air compressors, engine parts, etc. These parts are available 24 hours daily—ready at a moment's notice to service all EMC equipment now operating throughout the country, even including motor cars built in 1924. Supplementing this parts service, EMC also maintains a staff of experienced service engineers who are located at nationally strategic points to serve all users of EMC equipment.

The economic value and the money-saving benefits of this service are reflected in the high availability records of all types of EMC Diesel motive power.



ELECTRO-MOTIVE CORPORATION
SUBSIDIARY OF GENERAL MOTORS LA GRANGE, ILLINOIS, U. S. A.

Purchasing and Stores

L. S. MYERS, division storekeeper on the Northern Pacific at Seattle, Wash., has been promoted to assistant general storekeeper, with headquarters at South Tacoma, Wash., succeeding Frank C. Turner.

FRANK C. TURNER, assistant general storekeeper on the Northern Pacific at South Tacoma, Wash., has been appointed general storekeeper, with headquarters at St. Paul, Minn., succeeding H. M. Smith, retired.

Obituary

WILLIAM L. TROUT, superintendent of motive power of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn., died in that city of a heart attack after a short illness, on July 21. Mr. Trout was born at Altoona, Pa., and entered railway service with the Pennsylvania on January 3, 1895, serving as an apprentice, machinist and enginehouse foreman at various points until October 31, 1913. At that time he left the Pennsylvania to go



William L. Trout

with the Western Maryland as general foreman in the mechanical department at Cumberland, Md., holding this position until February 28, 1915. On that date he went with the Baltimore & Ohio, where he served as general foreman in the locomotive department and acting master mechanic at Philadelphia, Pa. On January 1, 1916, he entered the service of the Long Island (part of the Pennsylvania) as general foreman in the car department at Jamaica, N. Y. From September 1, 1918, to June 31, 1924, he served with the Galena Signal Oil Company as mechanical expert at Chicago. At the end of this period he entered the service of the Uintah Railway as superintendent of motive power at Atchison, Colo., holding this position until June 31, 1925, when he resigned to become a special representative in the railway department of the Hulson Grate Company. From September 1, 1926, to December 31, 1932, he was a sales representative for the Gustin-Bacon Manufacturing Co. On February 1, 1935, he entered the service of the Minneapolis & St. Louis as a motive power inspector,

being promoted to general master mechanic on March 1, 1935. In August, 1937, he was advanced to superintendent of motive power, with headquarters at Minneapolis, the position he held at the time of his death.

GEORGE ROBERT GALLOWAY, superintendent of motive power, Western lines, of the Baltimore & Ohio, with headquarters at Cincinnati, Ohio, died at the Samaritan Hospital, Cincinnati, on July 20. Mr. Galloway was born at St. Thomas, Ont., on July 5, 1889, and entered railroad service in October, 1905, with the Michigan Central, as a shop apprentice at St. Thomas. On April 1, 1916, he went with the B. & O. as assistant master mechanic at Glenwood, Pa., later serving as master mechanic at Lorain, Ohio; general master mechanic, Southwestern district at Cincinnati; district master mechanic at Cincinnati; and district master mechanic, Maryland district, at Baltimore, Md. On February 1, 1931, he was promoted to superintendent of motive power, Western lines, with headquarters at Cincinnati and on December 1, 1936, he was appointed superintendent of motive power, Eastern lines, with headquarters at Baltimore. Mr. Galloway returned to Cincinnati as superintendent of motive power, Western lines, on June 1, 1940.

JOHN WINTERSTEEN, vice-president and general manager of the Cornwall Railroad, died of heart failure at his home in Lebanon, Pa., on June 18, at the age of 65. Mr. Wintersteen was born on May 10, 1875, at Summitt Hill, Pa. He was taught the trade of boilermaking during his youth and served the United States during the Spanish-American War, as a boiler tech-



John Wintersteen

nian for ships plying between the United States and Cuba. In 1898, immediately following the war, Mr. Wintersteen entered the service of the Philadelphia & Reading as boilermaker on the Philadelphia division. From 1902 until 1906, he was employed as boiler inspector, being appointed boiler foreman in the latter year. From 1911 to 1916, Mr. Wintersteen served under the Interstate Commerce Commission of the United States Government, on the Philadelphia division of the Reading.

In 1916, he became master mechanic of the Cornwall Railroad at Lebanon, being appointed general manager in 1923. In 1932, Mr. Wintersteen was elected vice-president and general manager, in which capacity he served until the time of his death. Mr. Wintersteen was a member of the New York Railroad Club.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

BENDER AND TUBE FABRICATING EQUIPMENT.—The Parker Appliance Company, 17325 Euclid avenue, Cleveland, Ohio. Bulletin No. 40 E—Instructions and price list.

SAFETY EQUIPMENT.—The Boyer-Campbell Co., 6540 Antoine street, Detroit, Mich. Catalogue 40, "Equipment for Accident Prevention." Eye, face and head protection; machine-tool guards; safety tongs; clothing and gloves, etc.

PORTABLE ELECTRIC TOOLS.—Skilsaw, Inc., 5033-43 Elston avenue, Chicago. Catalogue No. 41, 52 pages. Illustrates and describes complete line of Skilsaw portable electric tools and their uses.

FLAME HARDENING APPARATUS.—Air Reduction Company, 60 East Forty-Second street, New York. 12-page bulletin. Describes Airco Style 4383 water-cooled flame-hardening torch and the variety of extensions and types of tips for use with it.

METALLIZING EQUIPMENT.—Metallizing Company of America, Inc., 562 West Washington boulevard, Chicago. Sixteen-page booklet on Mogul Model P and S metallizing gun, and 24-page booklet on various metallizing applications, with history on aluminizing process for combating oxidation from high temperatures.

AIR FILTER PANELS.—Air-Maze Corporation, 5200 Harvard avenue, Cleveland, Ohio. Twenty-page bulletin descriptive of Air-Maze filter panels for various fields.

COPPER, BRASS AND BRONZE PRODUCTS.—Revere Copper and Brass, Incorporated, 230 Park avenue, New York. Handbook of tables of weights and data on copper, brass and bronze products for engineers, draftsmen, estimators and designers.

KENNAMETAL TOOLS AND BLANKS.—McKenna Metals Co., 182 Lloyd avenue, Latrobe, Pa. Six-page folder, Bulletin 740, of factual data on Kennametal for machining steel of hardnesses up to 550 Brinell.